RESEARCH AND FARMING

SIXTY-SIXTH ANNUAL REPORT

Agricultural Experiment Station
North Carolina State College of
Agriculture and Engineering of
The University of North Carolina

1943

RESEARCH AND FARMING 1943

I. O. Schaub, *Dean of Agriculture*
L. D. Baver, *Director, Agricultural Experiment Station*

SIXTY-SIXTH ANNUAL REPORT

Agricultural Experiment Station
North Carolina State College of
Agriculture and Engineering of
The University of North Carolina
Fiscal Period July 1, 1942-June 30, 1943
Progress Report for Dec. 1, 1942
To Nov. 30, 1943, Raleigh

STATE INSTITUTIONS COOPERATING IN AGRICULTURAL RESEARCH

State College of Agriculture and Engineering Of The University of North Carolina

Frank P. Graham, *President*
J. W. Harrelson, *Dean of Administration*
I. O. Schaub, *Dean of Agriculture*

N. C. Department of Agriculture Raleigh, N. C.

W. Kerr Scott, *Commissioner*
F. E. Miller, *Director of Branch Stations**

* The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

TABLE OF CONTENTS

To the Governor of North Carolina, the Board of Trustees and President of the University of North Carolina and the Dean of Administration of the North Carolina State College of Agriculture and Engineering:

I am transmitting herewith the report of the Agricultural Experiment Station for the year ending June 30, 1943.

Respectfully submitted,

L. D. Baver

Director,
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION.

Agriculture and The War

The farmers of North Carolina are meeting the challenge of all-out production of agricultural products for the war effort with undiminished patriotism and hard work. Their heritage has been to produce and they have been applying all their resources toward maximum production. As they till the soil in the face of adverse weather conditions, rising costs of production, and acute labor and machinery shortages, they undoubtedly wonder what lies ahead for them.

Not only do North Carolina farmers ask themselves this question but also all the farmers of America and of the world at large. No better answer can be given to this question than that suggested by the Minister of Agriculture of Great Britain when he proposed that the 1944 motto for England's farmers could be summed up in two words—*efficiency* and *opportunity*. His message carries hope for all farmers when he says:

"It is because of my knowledge of the improvements that British farmers have themselves achieved in the war years, that I believe they can and will do still more in the future. I base this belief not only on their wholehearted support of the war effort and on the actual figures of the additional food produced, but even more perhaps on two attributes which cannot be set down in figures and which are worth more than money: first, the love of the farmer for his calling, for his land, for his stock, for all that country life stands for; and second, the personal service which the war has shown he is prepared to give to the betterment of the industry.

"Then opportunity—I firmly believe that the industry has within its grasp an opportunity to establish a proper place in the national economy. The place is waiting there for it to fill but every man must play his part, must raise the standard of every branch of production, particularly live stock, must utilize every modern method of reducing costs and of improving quality, and must play his part, and a wise part, in the organization of the industry, both internally and in relation to distribution and other interests. The great hope of democracy is that all of us, not merely political leaders, should be statesmen.

"I know of no industry that in this war has so resolutely pulled itself up by the roots and revolutionized its outlook and practice. Better methods, better cultivations, better seeds, better use of machinery and fertilizers, new developments of all kinds: many farmers have glanced longingly at them for many years in the shop windows, but they had neither the money nor the security to dare

go into the shop and examine them. The war years have shown they are ready to seize the opportunity of doing so.

"This spirit must continue. I believe in a progressive agriculture, not only for the benefit of those engaged in it, but as a potent factor in restoring prosperity to the nation."

One cannot place too much emphasis on efficiency in agricultural production. Reduced costs of production and increased quality of farm products must be the goal of every farmer if agriculture is to be a progressive influence in our national prosperity. This has always been the goal of the Agricultural Experiment Station and the Agricultural Extension Service. The contribution of the Agricultural Experiment Station to the betterment of agriculture is well illustrated in the July, 1943, issue of *Capper's Farmer*. The following quotation from this farm paper emphasizes the importance of research and extension in agricultural production:

"WE ARE NOT HUNGRY. THERE IS NO FAMINE IN THE LAND. Starvation is not one of our problems. Plagues born of malnutrition are unknown here. Our people are physically strong. They are well nourished by comparison with peoples elsewhere. In no other country is there such variety and abundance of food. Even though we have resorted to mild rationing, great stores of life-giving sustenance still are available.

"For this plenty we are indebted to scientific research in agriculture. To this research the country owes its very existence. To extension of research discoveries into practical application on farms, the country owes its freedom from hunger. To both of these and the agencies responsible for them—the Agricultural Experiment Stations and the Agricultural Extension Services—the nation owes its future security. For these are the discoverers and distributors of knowledge which make more and more food production possible to feed more and more millions who man the wheels of progress.

"Without the knowledge revealed by scientific research, without its translation into farm practices, 6 million farmers could not feed themselves and the remaining 127 millions of their fellow countrymen, plus many millions more in foreign lands. Without that knowledge millions upon millions of men and women would not be free to man our industries and our vast war production.

"How have fewer and fewer farmers been able to feed more and more people? Only by the application of better methods. And those methods have evolved from experiments conducted by the experiment stations and from knowledge carried to farms by the extension services.

"For these agencies there is no substitute. They have sustained the energy and effort of farmers in the past and unhindered they will do so in the future."

RESEARCH AND FARMING gives to the people of North Carolina the outstanding achievements of the Agricultural Experiment Station for 1943. Surely, the facts contained in this report indicate that we are on the road to increased efficiency in agriculture in our State.

L. D. BAVER,
Director.

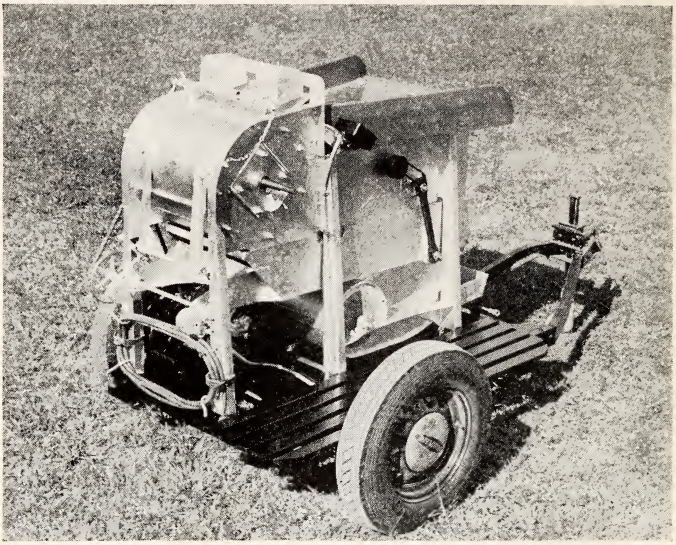


FIG. 1. SOYBEAN THRESHER AND CLEANER.

AGRICULTURAL ENGINEERING

Soybean Thresher and Cleaner Developed

A soybean thresher and cleaner for experimental plots was designed and built during the summer of 1943 in time for use in the fall. The machine was very satisfactory and indications are that it is superior to other machines now being used by experiment stations. It is mobile, efficient in threshing and cleaning, easily adjusted, simple, compact—cleaning mechanism under feeding platform, has electric motor power for easy starting and stopping, has enclosed anti-friction bearings which require no oiling, and is balanced for smooth operation. (Fig. 1.)

New Seed Hopper and Leveling Device Designed for "Once-Over Machine"

A new seed hopper that will plant all seed including lint and delinted cotton seed was developed for the "Once-Over Machine" during the summer of 1943. It satisfies three necessary requirements for a planter of this type, it is simple, light in weight and easy running.

A new leveling device that attaches to the soil opener was also developed. It is designed to perform three functions: level the bed by scraping off the excess soil, cover the seed and form the soil into the shape of the rear packing wheel. These machines are being produced by the General Foundry & Machine Company of Sanford.

Three Point Plan for Tobacco Curing

A study of the physical changes in tobacco curing led to the following recommendations: (1) use of a heating jacket to distribute heat better, (2) use of a wet and dry bulb thermometer to show humidity, and (3) installation of stokers for firing the barns.

Figure 2 shows one type of heat distribution jacket that may be put over the first joint of the flue pipe. It serves to reduce high temperatures in the middle of the barn by distributing heat to the corners. The four distribution pipes may be adjusted to give desired temperature at any place in the barn.

The hygrometer, Figure 3, indicates the humidity. This instrument may be used to tell the proper setting of the ventilators and the temperature.

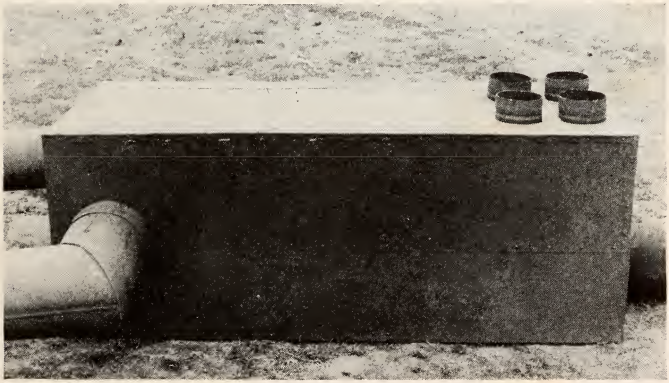
Stoker firing shown in Figure 4 not only operates at lower annual cost but also allows the curer to prevent damage to the leaf while curing. Even heating and control eliminate a great part of the danger from sponging, curing green or scalding. A time clock control on the stoker is as good or even better than thermostatic control.

Food Dehydrators for Home Use

An electric dehydrator that has practical home value is the one using the regular chick brooder unit as a heating element. Figure 5 shows a unit that has a small capacity—four square feet of tray area. It requires a drying time of ten hours for green beans, and as much as fourteen hours for apples.

Temperatures up to 150° can be reached in twenty minutes when the unit is loaded. A record of drying snap beans showed that the dehydrator required 1,300 watt hours for ten

FIG. 2. HEATING JACKET.



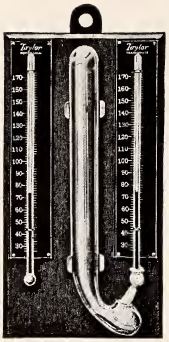


FIG. 3. HYGROMETER.

hours of operation. Its capacity is 660 watts.

This dehydrator gave a good dried product for apples and green beans, and for a small amount of corn.

The stove top drier is another home unit well adapted to farm homes where kitchen heat goes to waste. Racks may be suspended from the ceiling or set upon bricks resting on the stove top.

Tobacco Barn Used for Drying Sweet Potatoes

Sweet potatoes may be cut with the reciprocating knife machine shown in Figure 6. This machine is powered by a one-half horsepower electric motor and has a capacity of about 500 pounds per hour.

The knife, a standard beet knife, makes approximately 60 strokes per minute, and cuts only on the down stroke. Shred cut is approximately $^{3}/_{16}$" x $^{3}/_{16}$".

The hopper is hinged for easy cleaning and the knives are removable and adjustable. The machine is not satis-

FIG. 4. TYPICAL STOKER INSTALLATION.

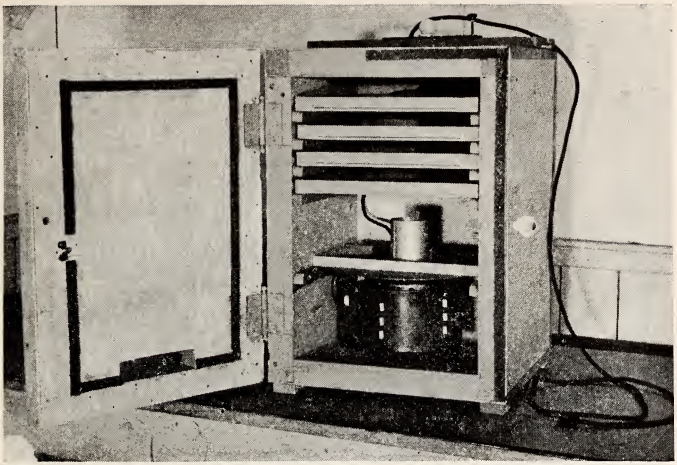


FIG. 5. A PRACTICAL HOME DEHYDRATOR USING A CHICK BROODER HEATING ELEMENT AND THERMOSTAT.

factory for handling large quantities at a time.

Several types of trays were investigated but only the slat bottom and hardware cloth bottom trays were completely successful. Drying in the tobacco barn depended upon the outside temperature and humidity, the type of tray used, and upon the loading of the tray.

Dried sweet potatoes had a yellowish brown color with some gray intermixed. Bulk reduction by drying is not as much as the weight reduction. (Fig. 7.) Records kept on 612 pounds of shredded material showed that they lost 389 pounds (63.6 per cent of wet weight) of water, and produced 223 pounds (36.4 per cent of dried material). A bushel of dried material weighs about 24 pounds while fresh unshredded potatoes will weigh about 50 pounds.

Drying Sweet Potatoes With Air

Some experiments were made with air drying. Each rack used in these tests held 15 trays containing a total of 120 pounds of fresh sweet potatoes.

The racks were not exposed to the weather, but left setting in an open shed for five days. Four of these days were overcast and foggy, with little wind and occasional rain. The fourth day, the material was still wet, but the fifth day, which was cool with a good breeze, completed the drying. The freedom of air movement through the trays is a big factor in air drying.

Use of Tobacco Redrying Plants for Sweet Potato Drying

With the cooperation of the Rocky Mount Chamber of Commerce, and the G. R. Garrett Company, Inc., of

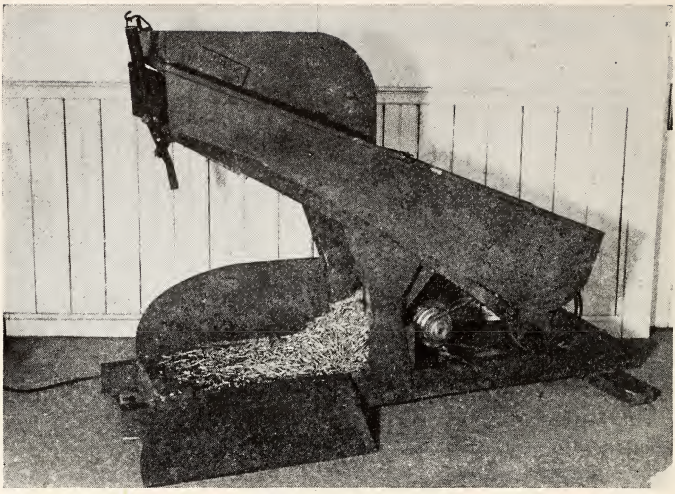


FIG. 6. SWEET POTATO SHREDDER WITH RECIPROCATING KNIFE.

FIG. 7. FRESH POTATOES WEIGHING 500 GRAMS, 500 GRAMS SHREDDED MATERIAL AND 160 GRAMS DRIED. THEY ALL STARTED AT THE SAME WEIGHT.

Rocky Mount, several sweet potato drying experiments were conducted with a tobacco redrying machine. The machine was 140 feet long, and divided into sections, the air movement in one section being upward through the belt, and in the next, downward through the belt.

Time for drying will of course vary with the moisture of sweet potatoes, the type of shred, rate of loading, the temperature, humidity, and air movement in the drier. Thirty to fifty minutes were required for drying the material.

FIG. 8. FIELD OF HYBRID SEED PRODUCTION ON FARM OF H. M. WIGGINS, ROBBINSVILLE. PAIRED ROWS SHOWING NO TASSELS ARE THE FOUNDATION SINGLE CROSS HYBRIDS. BETWEEN EACH PAIR IS TASSEL BEARING ROW OF MALE PARENT, HOLCOMBE'S PROLIFIC, STANDARD VARIETY USED IN PRODUCING TOP CROSS HYBRID SEED.

FIELD CROPS

CORN

Produce Seed of Hybrid Corn[1]

Forty-five North Carolina farmers used foundation seed stocks provided by the Experiment Station to produce 500 bushels of hybrid seed corn in 1943. These men were chosen to represent every section of the state except the Lower Coastal Plain where present Station hybrids are poorly adapted. The farmers, the North Carolina Crop Improvement Association, and the Experiment Station cooperated in this program.

Foundation seed stocks were sold to the grower by the North Carolina Crop Improvement Association which also provided detailed information on planting, detasseling, and harvesting the crop. The grower planted these foundation stocks in 2-row blocks in a field of his own variety and pulled the tassels from them as they emerged. The silks of these detasseled foundation plants consequently were wind pollinated by pollen from the farmer's variety and the seed harvested from them was hybrid seed (Fig. 8).

Before planting a seed field of

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

hybrid corn, the farmer should take into consideration the 35 man hours of labor required to pull tassels from seed rows of a one-acre crossing plot.

Add Ten Bushels Per Acre By Planting Top-Cross Hybrid Seed[1]

Farmers planting the hybrid seed they produced in 1942 reported increases of as much as 10 bushels per acre (Fig. 9). For instance, on two private farms in Bertie County, N. C. hybrid T1 produced an average of 54.3 bushels per acre as compared to 43.7 bushels for Jarvis Golden Prolific: a 24 per cent increase. In experimental plantings in the same county this hybrid produced 28 per cent more grain than the standard varieties.

As an average of three tests in the Northern Coastal Plain, the four best hybrids (T1, T2, T12 yellow hybrids and T8, a white hybrid) exceeded the grain yield of the standard white varieties by 9 per cent and of standard yellow varieties by 22 per cent.

These hybrids are damaged more by grain weevil than are the best local varieties but not as much as are western hybrids. N. C. hybrids T11, T12, T1, and T2 averaged 17 per cent more grain than the white standard variety and 31 per cent more grain than did the yellow standard variety in four tests grown in the Piedmont area. These four yellow hybrids were about equal in grain yield.

New Double Cross Hybrids Ready for Farms[1]

In the northern Piedmont and Mountain areas, U. S. hybrid 282, a yellow hybrid, had the highest two-year record in the Official Variety Tests. In these mountain tests, U. S. 282 averaged 91.2 bushels while Hol-

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 9. FIELD OF N. C. HYBRID T11 ON THE SPEIGHT SEED FARM, WINTERVILLE. HYBRID PLANTS WERE ALL STANDING ERECT AT HARVEST TIME.

combe Prolific averaged only 72.5 bushels per acre. Three growers produced a total of 45 bushels of seed of this hybrid for planting in 1944.

Experimental double crosses have shown average increases of more than 20 per cent in grain yield over the standard varieties during the past three years in the areas where they are adapted. In addition to yield, these new strains possess other desirable characteristics.

Two yellow hybrids, N. C. 1028 and N. C. 1032, have exceptionally strong stalks and root systems (Fig. 10) which enables the plants to stand erect until harvest time. Erect plants are generally freer of grain rot and require less labor to harvest than do fallen plants.

The best white hybrids, N. C. 1111 and 1114, are high yielding and tolerant to insect grain pests (Fig. 11). However they do not stand as well as the yellow hybrids mentioned. Several of these new double crosses will be released in 1944.

Breeding Stocks Multiplied for Farm Production[1]

Inbred lines (pure breeding strains) developed from Southern corn varieties have been multiplied in the breeding nursery, and have been used as strains in producing the double crosses mentioned above.

Sufficient seed of these inbreds was obtained to permit a large increase in 1944. However, only a very limited amount of foundation single-crossed seed was produced. This single-crossed seed should produce approxi-

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 10. LEFT, PLANTS OF INBRED NC16 ARE STANDING ERECT, WHILE, RIGHT, PLANTS OF THREE DIFFERENT INBREDS HAVE BEEN BLOWN DOWN BY SUMMER STORMS. NC16 IS ONE OF THE STRONG STALKED PARENT LINES USED IN PRODUCING N. C. HYBRID 1032. PAPER BAGS COVERING EARS WERE USED TO CONTROL POLLINATION AND PREVENT NATURAL CROSSING WITH OTHER STRAINS PLANTED IN THE FIELD.

FIG. 11. TYPICAL EARS OF NC34 x NC52, A WHITE SINGLE CROSS USED IN THE DEVELOPMENT OF N. C. HYBRIDS 1111 AND 1114. ALL EARS ARE FULLY COVERED WITH GOOD HUSKS WHICH PROTECT THE GRAIN FROM INSECT PESTS, BIRDS AND WEATHER.

mately 100 to 200 bushels of double-crossed seed in 1944.

Further multiplication of the foundation seed stocks to permit larger production (probably 5,000 bushels of one hybrid) in 1945 is under consideration for the coming season. If this quantity of seed is available for several different hybrids adapted to different sections of the State, one-tenth of the 1946 corn crop could be planted with new hybrid strains.

Tender, Sweet Roasting Ears From Sweet Corn Hybrids[1]

Sweet corn hybrids produced 8,000 to 9,000 roasting ears per acre on the McCullers Branch Experiment Station. One reason for this increased yield was that most strains of sweet corn have smaller plants than do field (or starchy) strains, and so the plants can be spaced more closely than ordinary field corn.

The experiments showed that where sweet corn is grown as a truck crop it should be fertilized heavily as are most garden and truck crops and that early to medium plantings (April 1 to May 15 at McCullers) were satisfactory. They also showed that if roasting ears are desired over a period of several weeks, two or three plantings should be made using strains of different maturity, however, the medium to late maturing types are generally more productive than the extremely short seasoned types.

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

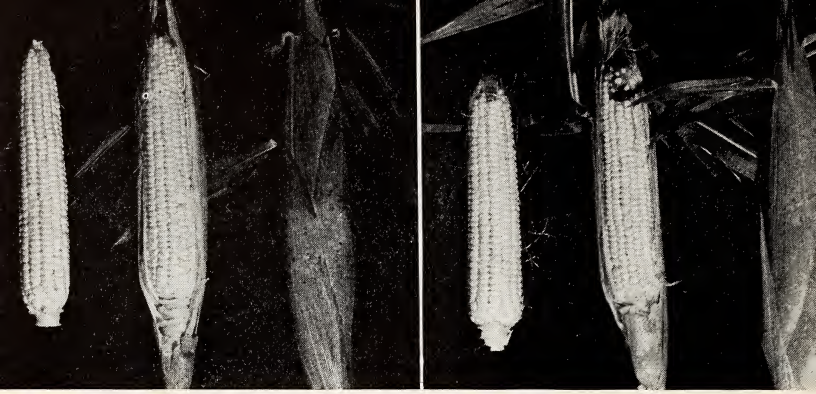


FIG. 12. LESS EARWORM DAMAGE HAS BEEN CAUSED ON THE EXPERIMENTAL HYBRID (Tx 3616-4-3-1-1 x P14), LEFT, THAN ON THE STANDARD HYBRID GOLDEN CROSS BANTAM, RIGHT.

The following sweet corn hybrids have appeared good:

	Days from Planting to Roasting Ear Stage
Yellow	
Lincoln	75-80
Ioana	78-82
Golden Cross Bantam	75-80
Senaca Giant	85-90
White	
Evergreen Hyb. 3 x 33	85-90
Hyb. Stowells Evergreen	85-90

Earworm damage that is often serious in sweet corn production can be largely prevented if long, tight husks cover the ear. Therefore, experiments have been conducted for three years to develop a strain of sweet corn with high table quality and good husk characteristics. The results between an experimental hybrid and a standard hybrid are shown in Figure 12. Both have excellent table quality.

Great Difference In Corn Hybrids Shown[1]

The results of the 1943 Official Corn Performance Tests show that corn hybrids differ widely in such important characteristics as yield, weevil resistance, grain quality, and ability to stand up. The results also show that many hybrids now developed are distinctly superior to local open-pollinated varieties, whereas other hybrids are no better than the varieties, or even distinctly inferior to them.

Figure 13 contains a summary of the ranges in yield shown by hybrids and the open pollinated varieties in the 1943 official tests.

The results of the six performance tests show that hybrids are specific in their regions of adaptation; consequently, the most reliable recommendations must come from reliable tests in the general region where the commercial hybrids are to be grown.

For example, tests conducted in the Cornbelt are of little if any definite value in determining the performance of a hybrid under North Carolina conditions. The Cornbelt hybrids were in general very susceptible to weevil

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

and produced grain of low quality in North Carolina.

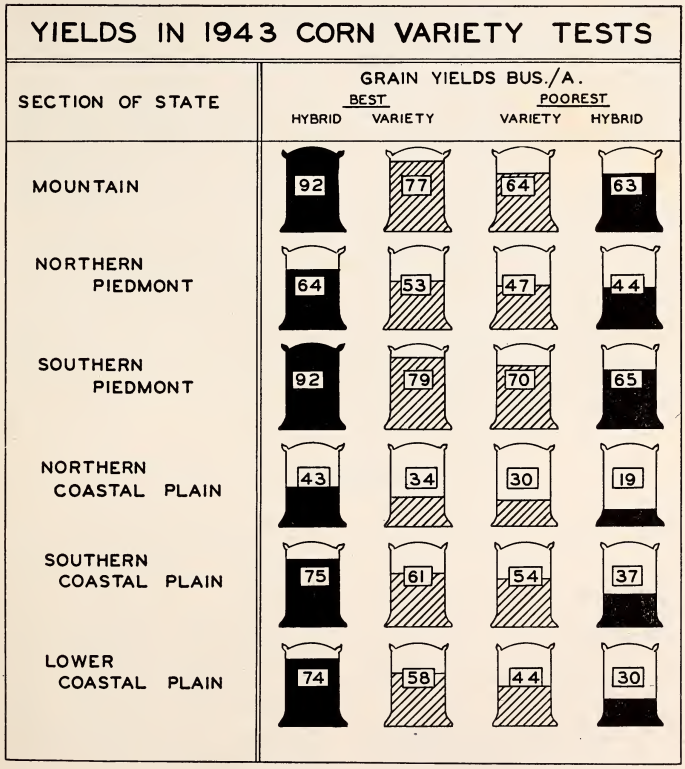
And in one plot of the Official Variety Test a Cornbelt hybrid showed 80 per cent of the kernels damaged by weevil at the time of the harvest in late October.

Therefore, it can safely be said that unless hybrids are bought by *name* and upon the basis of *known performance* in that particular section nothing better than varying results need be expected at the time of harvest.

Corn Responds To Nitrogen Fertilization

Corn yields from four field experiments conducted during the 1943 season show that on soils of medium and

FIG. 13. DIFFERENCES IN RANGE OF GRAIN YIELDS OF CORN HYBRIDS AND ADAPTED OPEN-POLLINATED VARIETIES TESTED IN THE 1943 OFFICIAL VARIETY TESTS.



low fertility, nitrogen applications are very important. On these soils the yields were increased as much as 25 bushels per acre, and never less than 8 bushels where a side-dressing of 32 pounds of nitrogen was applied.

No response to nitrogen side-dressing was obtained on one field, a silt loam soil in a high state of productiveness. Here, sufficient nitrogen was already present to produce a high yield of corn.

Three sources of nitrogen were used in this experiment: nitrate of soda, ammonium nitrate, and nitrogen solution No. 32. No significant difference was found in the results from any of the sources.

Treatment of Corn Seed Increases Stands Under Certain Planting Conditions

Seven lots of corn seed, each grown in a different location in 1942, were treated with Semesan Jr. and planted in 1943. These treated and untreated seed were planted in each of three locations in North Carolina.

A 15 per cent increase in stand was obtained from treated seed in a planting made on the Piedmont Branch Station Farm. At the Upper Coastal Plain Branch Station a 5 per cent increase occurred. At the Blackland Station, no increase resulted from treatment. The differences in results obtained at the three stations are believed to be due to different soil moisture and temperature conditions prevalent during the germination period.

Since the cost of the material used is only 7 cents per bushel of shelled corn, treatment of seed corn would appear to be reasonable insurance against poor stands that sometimes result when conditions unfavorable for germination of corn seed follow planting.

Legume Content of Sod Important To Corn

A permanent pasture experiment that had been conducted since 1937 was plowed in 1943 and planted to corn. A poor stand of corn made it impossible to see the full effects of the different sods on the productivity of the land. However, corn yields averaged 8 bushels more per acre where a grass-lespedeza sod was turned down as compared with a pure grass sod.

The results definitely show that the effectiveness of a sod in improving the productivity of a sandy soil is dependent upon the presence of legumes in it.

COTTON

In Sidedressing Cotton Amount of Nitrogen More Important Than Source[1]

The effect on cotton yields of sidedressing with 16 and 32 pounds of nitrogen was studied in one-year experiments on six soil types. Three different sources were tested—nitrate of soda, ammonium nitrate, and a solution containing 32 per cent nitrogen. An average preplanting application of 12 pounds of nitrogen was made.

Sixteen pounds of nitrogen sidedressed increased cotton yields on Norfolk sand, Norfolk sandy loam, and Marlboro fine sandy loam in the Coastal Plain. On the first two soil types, ammonium nitrate and the nitrogen solution produced somewhat higher yields than did nitrate of soda. A possible explanation is that the heavy rains falling in June and early

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

July leached out the greater portion of the nitrogen supplied as nitrate of soda. On the other hand, part of the nitrogen in ammonium nitrate and in the nitrogen solution used was in the ammonia form and was thus resistant to leaching.

On the Marlboro fine sandy loam there were no appreciable differences between sources of nitrogen. On all soil types in the Coastal Plain, 32 pounds of nitrogen sidedressed gave a small increase in yield of seed cotton over 16 pounds.

In the Piedmont, sixteen pounds of nitrogen sidedressed gave an increase in yield on Alamance silt loam in Union County. The source of nitrogen did not materially influence the yield. There was no response on Davidson clay loam or on Appling sandy loam in Davie County. Potash was one of the limiting factors on Appling sandy loam, however.

Value of Cover Crops for Cotton Influenced By Rotation[1]

The effect of cover crops on yield of cotton grown in two rotations, cotton-peanut and cotton-corn, is being determined on Norfolk very fine sandy loam at the Upper Coastal Plain Experiment Station. The cotton yields for 1943 are given in Figure 14.

In the cotton-peanut rotation there are practically no differences in yields of cotton following hairy vetch, crimson clover, Italian rye grass, and no cover. Austrian winter peas, however, increased the yield of cotton 164 pounds as compared with no cover.

Substantially higher yields of cotton, after each of the cover crops, were produced in the cotton-corn rotation. The effect of vetch on cotton growth is shown in Figure 15. At the same time the leguminous cover crops brought about increased yields of seed cotton over Italian rye grass.

These data on the response of cotton to cover crops suggest that corn leaves a lower amount of nitrogen available for the subsequent crop of cotton than does peanuts. This is because corn is a non-legume and uses most of the available nitrogen in the soil, while peanuts is a legume and gets the greater share of its nitrogen from the air.

Side Placement of Fertilizer Important for Good Stands and Yields of Cotton[1]

Fertilizer placed under the seed produced 604 pounds of seed cotton per acre at the Upper Coastal Plain Experiment Station in 1943, whereas the placement of fertilizer in bands two inches to each side of the seed gave 1,031 pounds, and placement in bands one inch to each side of the seed gave 1,157 pounds.

Placement of fertilizer also had a marked effect on the number of plants. A count of the cotton plants one week before chopping showed that the plots in which the fertilizer was placed by either of the band methods to have twice as many plants as those plots with the fertilizer beneath the seed. At harvest, this ratio still held.

The chief effect of placement of fertilizer on stands is related to the amounts of soluble salt in the root zone. Measurements of the amounts of soluble salt in the root zone at chopping showed that in the under the seed placement there were 50 per cent more soluble salts present than in either of the other two treatments.

Fertilizers containing low and high amounts of soluble salts were tested in the above experiment. One week before chopping 35 per cent more plants had emerged in the rows receiving low salt fertilizers. In 1943

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

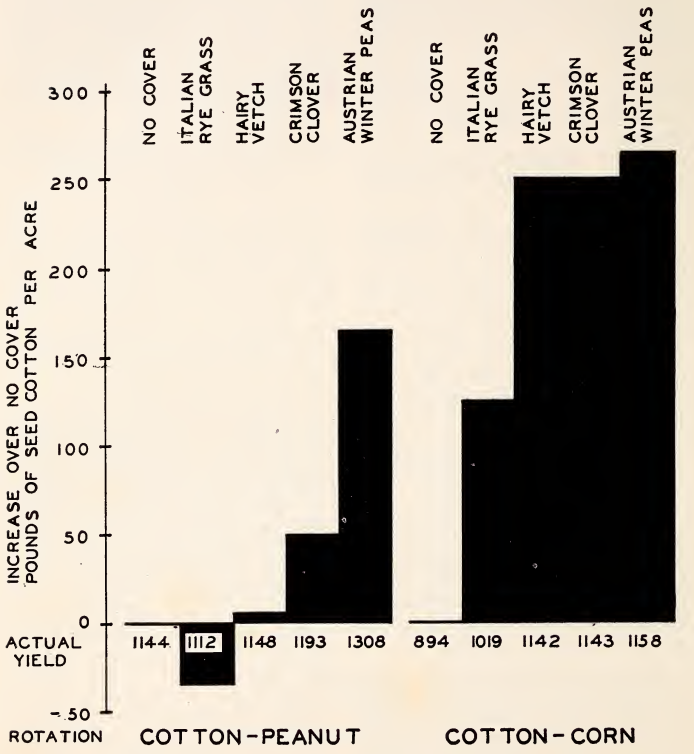


FIG. 14.

tests there was little difference in the yields of cotton from the fertilizers containing low and high amounts of soluble salts.

Quality of Cotton Fiber

Promising strains that had been inbred and selected for six generations were planted in 1943 and the blooms selfed to increase the amount of self-pollinated seed.

Strains within varieties are showing differences of 15 per cent in fiber diameter, while differences between varieties for this property amount to approximately 20 per cent. A prom-

inent cotton manufacturing company that is interested in cotton quality will be furnished samples of those strains showing big differences in fiber diameter. This company will make spinning tests and certain fiber measurements from the samples. A cooperative study of the results will be conducted.

The 1942 crop of strains of cotton from the breeding program was grown at Rocky Mount and Statesville. Ten of the same strains were grown at each location and, therefore, it has been possible to determine in a limited way the influence of location upon certain fiber and seed characters.

Fiber diameter and the percentage of oil in the seed were lower at Rocky Mount. Fiber bundle strength and staple length (as measured by optical methods) were higher at Rocky Mount. The results do not show any real differences between the two locations in fiber fineness (as measured by surface area), commercial staple length, and the percentage of thin-walled fibers. However, it seemed that there was a tendency for more thin-walled fibers to occur in the samples grown at Rocky Mount. The weather there was very dry during the period of fiber growth, while for the same period, the rainfall was normal to abundant at Statesville.

Spinning Quality of Fiber Influenced By Variety and Weather Conditions[1]

The best fiber quality was produced by inbred lines isolated from the Stoneville 4B, Stoneville 2B and Mex-

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 15. COTTON GROWN IN A COTTON-CORN ROTATION WITH NO NITROGEN APPLIED. THE NO COVER CROP PLOT (LEFT) PRODUCED 791 LBS. OF SEED COTTON. COTTON AFTER VETCH (RIGHT) PRODUCED 1,274 LBS. OF SEED COTTON.

ican varieties. However, the majority of these lines are not quite as productive as the Coker 100 and Deltapine varieties.

Segregation and recombinations of fiber characters were observed in the progenies of hybrids. Two sister lines showed wide differences in fiber strength and X-ray angle. A selection from a four-way cross had a finer Hertel fiber index than either of its parents. Among several breeding stocks from other states that were included in the yield tests, the most outstanding was Stoneville 62-1-10 from the Oklahoma Experiment Station.

The quality of the fiber may vary from year to year at the same location, between locations, and between pickings in the same field. Weather conditions, particularly rainfall during the development of the fiber, affect the length, fineness and strength of the fiber. Varieties grown under the same conditions are usually affected in much the same way. Twenty inbred lines grown at Statesville had consistently stronger and finer fiber, and smaller X-ray angles in 1943 than in 1942. The length of staple of 10 varieties averaged $^{3}/_{32}$ inch longer from the second picking than from the first at Statesville. The oil content of these varieties was consistently higher at Statesville than at Rocky Mount the same year.

Some evidence of hybrid vigor was found in comparing the first and second generations of six crosses with their parents. The first generation of all crosses produced significantly higher yields than either parent, and were with one exception higher than the second generation. Certain crosses also showed significant differences in rate of blooming and earliness.

New Cotton Strains Tested for Adaptation[1]

Many new strains of Coker 100 and Coker 100 Wilt were tested for adaptation in the 1943 Official Variety Tests.

The range in yields of lint cotton per acre for all entries tested, including both experimental and standard strains, were: Southern Piedmont 818 to 447; Northern Coastal Plain 564 to 370; Southern Coastal Plain at Raeford 784 to 298; and Southern Coastal Plain at Wagram 935 to 749 pounds.

Highest yielding varieties in the Southern Piedmont test were Coker 200 strains 4 and 2, an experiment station select (AB x M), and Coker 100 strain 6. In the Northern Coastal Plain test, Coker 100 Wilt strains 1 and 3, Deltapine 14, and Coker 200 strains 3 and 4 were shown to be the best yielding varieties.

Deltapine 14, Coker 4 in 1 strain 6, Coker 200 strain 6, Coker 100 Wilt strain 3, and Stoneville 2B, were among the highest yielding entries in the Southern Coastal Plain test at Raeford. In the Wilt test at Wagram, Coker 100 Wilt strains 42-1, 2, 3, and 42-3, and Coker 4 in 1 strain 6 were among the high yielding entries.

Fiber Strength Is Inherited[1]

Cotton breeders are becoming more aware of the need of including fiber quality in the new strains introduced. Fiber strength, one of the factors thus being tested, has been found to be inherited in a complex manner.

When plants having high fiber strength are crossed to those with low strength, the first generation is intermediate. Two backcrosses have been made to the low strength parent. Although tests have been made on fibers from 250 plants in each backcross generation, the strength of the original hybrid has not been maintained even in the best selections.

As far as one can judge, high strength is inherited independently of

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

yield factors and of staple length. It is, however, correlated with the arrangement of the cellulose, a correlation which may be determined by the X-ray diffraction pattern. Also, evidence found in 1943 shows that high strength may be correlated with narrow diameters.

Selection for high strength involves all the difficulties a breeder meets in selecting for high yields. The plants cannot be chosen in the field but selections must be made on the basis of laboratory tests. Since fiber strength varies with the environment, unknown strains should be compared with a standard variety grown under the same conditions.

Initial Drying Determines Fiber Properties of Cotton[1]

In mature but unopened bolls, cotton fibers are hollow tubes. When the boll opens, the fibers collapse and twist as they dry out and never return to their original state.

When X-ray diffraction pictures are made of undried cottons, the characteristic crystalline pattern, known to be correlated with strength, is absent. The major portion of the cellulose is in an amorphous state, that is, uncrystallized. The living fibers show a degree of plasticity unknown in the dried cotton.

If the fibers are stretched as they dry, both length and strength are permanently increased. Cotton fibers that have not dried out are much more susceptible to fungal attack because the cellulose is in an amorphous condition. If there is a period of rainy weather during the early fall, the bolls that have cracked but not dried are thus more readily damaged than bolls already dried out.

Fibers and Seeds Grow At Same Time[1]

It is well known that lint percentage decreases with the rise in lint length, and the cause for this correlation has been investigated. It has been found that the fibers elongate as long as the seeds increase in size, and that fibers and seeds stop growing at the same time. For fibers an inch and an eighth in length, it was found that during the time the length of the hairs was trebled, the seeds increased ten times in volume. Thus, any increase in length results in a much greater increase in seed size.

The relative rate of growth of lint and seed were found to be the same in five different varieties of upland cottons. In varieties of the same staple length, differences in lint percentage are caused chiefly by: (1) differences in the size of the seeds at the day of flowering, and (2) number of hairs on the seed.

Rates of Seeding Reduced If Cotton Seed Treated

Tests made in 1943 at the Upper Coastal Plain Branch Station and at the McCullers Station show that the amount of seed required to give a satisfactory stand of cotton is much less for treated than for untreated seed.

Two varieties of about 85 per cent germination were used in these tests, variety C being heavily infested and variety D only moderately infested with disease-producing fungi. Half of the seed of each variety was left untreated and half was treated with Ceresan. The treated and untreated portions were each planted at 3 seeding rates; namely, 4, 7, and 10 seeds per hill (equivalent to approximately 13, 22, and 32 pounds per acre).

The untreated seed of neither variety gave a satisfactory percentage of surviving hills even where 10 seeds were planted per hill. Where treated seed was used, 4 seeds per hill of variety D gave a satisfactory percentage (96 per cent) of surviving hills.

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

These hills had an average of 3.3 plants per hill. Four treated seeds of variety C gave slightly less than a satisfactory percentage (94.2 per cent) of surviving hills, and an average of 2.9 plants per hill. Planting 5 treated seeds of variety C per hill would have given a satisfactory percentage of surviving hills with more than the needed number of plants per hill.

Where 7 seeds were planted, each variety gave a satisfactory percentage (97 to 99 per cent) of surviving hills, the hills having more than twice germinating 80 per cent or more. Less than one-third this amount of treated seed gave satisfactory stands in the tests here described and the labor incident to thinning was largely eliminated by planting in hills. At the highest rate of seeding (32 pounds per acre) untreated seed failed to give satisfactory stands (Fig. 16).

Benefits from Hormones on Cotton Seed and Cotton Plants Questionable

Four hormone preparations (each used at 3 dilutions) were added to

FIG. 16. INCREASED STAND OF COTTON SEEDLINGS RESULTS FROM SEED TREATMENT.
ROW 2, SEED DUSTED WITH DUBAY 1452-C.
ROW 3, CONTROL, SEED NOT DUSTED.
ROW 4, SEED DUSTED WITH DOW NO. 6.
ROW 5, SEED DUSTED WITH ARASAN.

as many plants as needed. Thinning was desirable where 7 and 10 treated seeds were planted per hill but was not necessary where 4 seeds were planted.

The usual recommended seeding rate for cotton is one and one-half bushels (48 pounds) per acre of seed cotton seed before planting. Seedling emergence was slightly reduced by one part of a-naphthalene acetic acid on 20,000 parts of seed, but one-half and one-fourth this amount did not visibly depress emergence.

None of the hormones used significantly increased the number of seed-

lings alive at thinning time. Attempts at appraisal of the different treatments by estimation of relative plant vigor were made on several occasions. At no time were plants from seed treated with hormones unquestionably more vigorous than the controls.

Where Rootone, Staleymone Powder, and Hormo-Fert Dust were used, increases of 68, 10, and 42 pounds of seed cotton per acre, respectively, were obtained. Statistical analysis indicates, however, that these increases probably were not due to the hormones applied to the seed but to uncontrollable random variation.

In two other tests, hormones were dusted onto growing plants, in which one, two and three applications were made on different plots at weekly intervals. Applications were made soon after inception of the blooming period on some plots and at the latter part of the blooming period on other plots. On 7 out of 8 plots dusted with fruitone, yield increases occurred. In no case, however, were these increases greater than might be expected from variation due to uncontrollable factors.

New Chemical Seed Protectants Increase Stands and Yield of Cotton

Ceresan, the material commonly used for dusting cotton seed before planting, was compared with certain other preparations in 1943 in plantings made at the Upper Coastal Plain Station and at McCullers.

All treatments increased the number of plants alive at thinning time and all but one (Spergonex) increased the yield of seed cotton by amounts that are highly significant. Arasan, Dow No. 5, GCC No. 1, Spergon, and Spergonex were somewhat less effective than New Improved Ceresan in increasing germination and reducing seedling losses after germination.

DuBay 1452-C gave as good or better results than New Improved Ceresan in respect to seedling stands. Since the active ingredient in DuBay 1452-C is less disagreeable than the active ingredient in New Improved Ceresan to people handling treated seed, it may eventually be substituted for Ceresan for cotton seed treatment.

Reginning of Cotton Seed Recommended

Reginned cotton seed was compared with fuzzy seed again in 1943. In 1941 and 1942, the reginned gave more rapid germination and a higher percentage of plants alive at thinning time than did fuzzy seed. In 1943, reginned seed gave stands equal to but not significantly better than seed not reginned at the Upper Coastal Plain Branch Station. At McCullers, in 1943, reginned seed gave lower seedling stands than seed not reginned. The decrease (26 per cent) was large enough to be significant when untreated seed was used in making the comparison, but was small (3.8 per cent) and insignificant when seed dusted with Ceresan was used. Significant difference in speed of seedling emergence was not observed between reginned and unreginned seed in 1943.

The failure of reginning to increase the amount and speed of seed germination in 1943 in contrast to 1941 and 1942, when increases occurred, is believed to be a result of differences in soil temperature and moisture during the germination period. The combined results of the three years of comparison of reginned and unreginned cotton seed indicate that the reginned will do better under average conditions existing at planting time than seed not reginned. The reginned should be treated with some seed protectant before planting. For planting purposes, removal of about one-half the short lint (125-150 pounds per ton of seed) is recommended.

Grazing Sudan Grass

A four-acre field that had been in alfalfa was grazed until June 15 when the seed bed was plowed and harrowed. The tift (rust resistance) sudan grass was planted June 17 at the rate of forty pounds per acre with 100 pounds per acre of Nitrate of Soda as a side dresser.

Grazing was started on July 19 and continued until September 7—a 40-day grazing period. During this time the number of milking cows varied from 13 to 18, and thus, the four acres gave a total of 3,025 hours grazing for the milking herd. (Fig. 17).

This is not a measure of what sudan grass will do in a normal year. For example, this field was adjacent to an alfalfa field which normally produces four cuttings per year and last year, because of the drought, it produced only two cuttings.

Sudan grass grazing is of great help when developing permanent pastures. It makes it possible to avoid overgrazing, particularly last year because of the drought.

Apply Phosphate More Often Than Lime[1]

Results from a field in Buncombe County show that it is necessary to apply phosphate more frequently than limestone to pasture land. Limestone and phosphate were applied to this pasture in adequate quantities in 1940 with excellent response from both materials.

The pasture was treated again in the fall of 1942 with a definite response from this second application of phosphate but no additional yield or better appearance from the extra limestone. This shows the need for rephosphating pastures at least every three years but not for reapplying limestone that often.

[1] Cooperation. Tennessee Valley Authority.

FIG. 17. AYRSHIRE COWS GRAZING TIFT SUDAN, PIEDMONT DAIRY RESEARCH FARM, STATESVILLE.

White Clover Responds More Than Lespedeza To Phosphate[1]

Although limestone and phosphate were the most effective materials in increasing the growth of pastures in 1943, the increase from phosphate was much higher than usual, apparently because there was a much higher than normal percentage of white clover in the sod this season.

White clover frequently responds to phosphate applications on soils that contain enough phosphorus for satisfactory growth of lespedeza. An example of this is the increase in yield from phosphate applications on an experiment in which lespedeza was the dominant legume one season and white clover dominant the next. The yields are as follows:

	Increase in yield due to phosphate
1942 lespedeza dominating ...	29%
1943 white clover dominating ...	55%

That this response is due to the change in legumes is shown by plant population counts from these same plots.

	Increase in plant population due to phosphate
1942 increase in lespedeza	10%
1943 increase in white clover ..	340%

In another experiment, white clover was found to respond much more to potash than did lespedeza. Both of these examples show that it will be necessary for farmers to use fertilizers more liberally when attempting to grow white clover in their pastures.

One Ton of Limestone Lasts Long On Pastures[1]

The results with limestone from an experiment in Haywood County are of particular interest to farmers in war time. This pasture has been through its sixth growing season since limestone was applied. At the end of the sixth season, the 2,000-pound rate of limestone is maintaining yields and plant population equal to those from the 4,000-pound rate. This illustrates the long lasting benefit from moderate applications of limestone to pasture land.

Additional evidence to show that excessive rates of application of limestone are unprofitable is found in the results from an experiment in Cherokee County. Here 1 ton of limestone is producing just as satisfactory results as 2, 3, or 4 tons at the end of the third season following treatment.

Potash as well as limestone seems to be necessary to control broomsedge in some pastures. This is the second season that potash and limestone have reduced the broomsedge by more than one-half when used together. When used alone neither material affected the percentage of broomsedge. Bluegrass appears to be the competing plant crowding out the broomsedge under the limestone and potash treatment in this experiment.

Type of Plant Determines Yield In Coastal Plain Pastures[2]

The 1943 results at the Lower Coastal Plain Station show that the response to fertilization depends upon the type of plants growing in the sod. A Dallis grass-carpet grass sod without legumes produced 1,269 pounds of forage on the unfertilized area. Adding limestone, phosphate and potash did not increase the yield, but by adding 200 pounds of nitrate of soda the yield was raised to 2,165 pounds.

When low hop clover was added to the grasses, the yield was 1,444 pounds when unfertilized, 3,008

[1] Cooperation. Tennessee Valley Authority.
[2] Cooperation, Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

pounds when fertilized with limestone, phosphate and potash, and 2,679 pounds when nitrogen was added to these fertilizers. (Figures 18 and 19.)

Kent wild white clover behaved in much the same way. The yield of this clover plus the grasses was 1,371 pounds on the unfertilized area, but when the land was fertilized with limestone, phosphate and potash the yield was 3,175 pounds. Adding 200 pounds of nitrate of soda to the grass-white clover did not increase the yield.

Eight grass-legume combinations were tested under six fertilizer treatments. Low hop clover or Kent wild white clover treated with limestone, phosphate and potash produced the most economical forage. Neither of these legumes has to be seeded annually. Kent wild white clover is a perennial and new growth comes from the old crowns. Low hop clover is a winter annual but reseeds readily.

The fertilizer treatments consisted of 2 tons of limestone, 800 pounds of superphosphate and 200 pounds of muriate of potash per acre. These materials were applied in the spring of 1940 and have not been reapplied. The nitrate of soda was applied at the rate of 200 pounds annually.

An additional advantage from low hop clover is that approximately one-half of the yield is realized during April and May and before the grasses have made much growth.

Different systems of management have shown that providing a rest period either in the spring or fall is necessary if Dallis grass is able to compete successfully with carpet grass. Since the yield was twice as large when no harvests were made in the spring as when none was made in the early fall, it would appear that the rest period for a portion of the pasture should come in the spring.

Field and greenhouse yields have been greater for Dallis grass than carpet grass. The more productive Dallis grass is also more responsive to increased soil fertility levels than is carpet grass. Carpet grass, on the other hand, is capable of tolerating more adverse cutting or grazing conditions. The extent to which Dallis grass can compete with carpet grass in permanent pastures is affected by available nutrients, the presence of legumes and proper management.

FIG. 18. DALLIS GRASS, CARPET GRASS AND LOW HOP CLOVER. YIELD: 719 POUNDS DRY MATTER DURING APRIL AND 866 DURING MAY. FERTILIZATION: LIMESTONE, PHOSPHATE AND POTASH.

FIG. 19. DALLIS GRASS AND CARPET GRASS. YIELD: 103 POUNDS DRY MATTER DURING APRIL AND 104 DURING MAY. FERTILIZATION: LIMESTONE, PHOSPHATE AND POTASH.

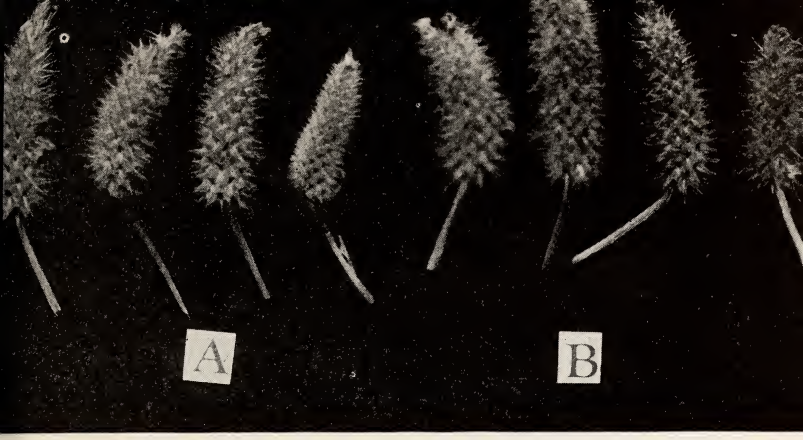


FIG. 20. EFFECT OF BORAX FERTILIZATION ON SEED HEADS OF CRIMSON CLOVER.
A. NO BORAX APPLIED, NOTE LACK OF VIGOR, FEW MATURED SEEDS IN APICAL PORTION OF THE HEAD.
B. 15 POUNDS BORAX APPLIED, HEADS ARE VIGOROUS AND WELL FILLED WITH SEED TO APEX.

Small Grains for Fall and Winter Pasture[1]

In experiments at the Piedmont Station carried on since 1936, rye has produced the most growth for fall and early winter grazing and barley has produced nearly as much grazing as rye and can be grazed later in the winter and spring. It has been grazed through January without reducing the grain yield, but fall grazing reduced the grain yield of rye. Oats has produced less growth than rye or barley and matures later in the spring.

To obtain early fall grazing the small grains were seeded in August. However, this early seeding has usually caused a severe rust injury to the wheat.

Effect of Borax On the Growth of Crimson Clover

Crimson clover seeded at the rate of 25 pounds per acre on a Cecil sandy loam soil gave no increase in hay yield when 15 pounds of borax per acre was applied. However, in a series of plots on which seed were allowed to mature, a significant increase in seed yield was obtained with an average yield of 271 pounds of cleaned seed per acre for the check. Where the 15 pounds of borax per acre was used, the average yield was 391 pounds, or an increase in yield of 2 bushels per acre.

The boron content of the seed was nearly doubled by the application of borax to the soil, but the germination quality of the seed produced was not affected by their boron content.

The increase in yield of seed from the borax addition is attributed to the growth of a more vigorous type seed head, and the development of fully matured, plump seed in the apical portion of the head. (Fig. 20.)

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

Borax Increases Yield of Alfalfa Hay and Seed

A continuation of the study of the effect of borax upon alfalfa production proves that it is needed for this crop in all sections of the state. Borax was used on alfalfa in the Coastal Plain at rates from 7.5 to 90 pounds per acre. It was applied after the second cutting in 1942, and yields were obtained in the 1943 growing season.

The application of borax at the 90-pound rate produced temporary burn on the plants in 1942. However, in the 1943 growing season there was no evidence of burn.

The average total yields per acre were as follows: check, 2,462; 7.5 pounds borax, 3,061; 30 pounds borax, 3,366; 45 pounds borax, 3,214; and 90 pounds borax, 3,069 pounds cured hay per acre. Obviously, the 30-pound addition gave the best response. The use of borax at all rates reduced yellowing caused by boron deficiency and promoted normal seed development.

Alfalfa Good In Piedmont and Coastal Plains[1]

Perennial hay experiments established in the fall of 1942 indicated that alfalfa can be successfully grown on both Piedmont and Coastal Plain soils. The experiment that was located on a Norfolk fine sandy loam soil in Johnston County produced three cuttings or a total of 5,000 pounds of dry matter per acre. (Fig. 21.)

The first year yields were slightly higher following the seeding of 30 pounds than from either 10 or 20 pounds, although the yields from the two lower seeding rates were satisfactory.

The experiment in the Piedmont was on a soil of medium to low productivity level, but the yields averaged 4,600 pounds of dry matter per acre. Yields increased with heavier seeding rates, although the difference between the 10- and 30-pound rate was only 500 pounds of forage on the heavier soil. The different rates of limestone had no effect on the yield the first year at either location. The pH of the Piedmont soil was approximately 7.0. The Coastal Plain soil had a pH of approximately 5.2, but the soil had been rather heavily fertilized immediately before the experiment was begun.

Phosphate and Lime Increase Sericea and Annual Lespedeza Yields[1]

In an experiment at the Piedmont Station, carried on for four years, an annual application of 250 pounds of superphosphate (20 per cent P_2O_5) to sericea lespedeza has increased the acre hay yield from 1.53 to 2.04 tons. Two tons of lime per acre applied before planting the sericea yielded 1.83 tons hay when used as the only treatment. When the lime was applied to the same areas as superphosphate, the hay yield was 2.13 tons. It was also proved that the superphosphate should be applied at least every 2 years.

The sericea hay was cut at a height of 12 to 14 inches with two cuttings each year, the first in June and the second in early August.

In a rotation of oats and annual lespedeza, Korean and Kobe varieties gave similar responses to fertilizer. However, over a 3-year period, Korean yielded slightly more than Kobe. Plots receiving annual applications of phosphate and potash yielded 1.17 tons per acre as compared with 0.72 tons without fertilizer. Two tons of lime applied once every 4 years added to the fertilizer increased the

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 21. GENERAL LAYOUT OF THE ALFALFA EXPERIMENT ON THE NORFOLK FINE SANDY LOAM SOIL. THE PHOTOGRAPH WAS MADE MAY 1. THE FOLLOWING DAY APPROXIMATELY ONE TON OF HAY PER ACRE WAS HARVESTED.

yield to 1.27 tons. In the same rotation, Lee 5 oats averaged 21.2 bushels without fertilizer and 30.2 bushels with the fertilizer treatment.

Common Vetch Adapted To North Carolina[1]

Common vetch has made as much growth as hairy or smooth vetch when grown at the Piedmont Station. The Willamette variety has been earlier than Oregon Common or Alba and is thus better adapted for green manure on sandy soils. Seed yields of Willamette were 112 pounds per acre in 1941 and 770 pounds in 1943. Smooth vetch yielded 158 pounds in 1941 and 451 pounds in 1943.

In 1941, the yield of Smooth vetch seed was lowered by a 28 per cent infestation of the vetch weevil and the low seed yields of 1941 were the result of spring drought. Common vetch may be injured during the winter, however, this occurs only during mild winters when growth is extremely rapid and temperatures of 10° F. or lower follow the mild period. From 1931 to 1943, this injury was severe only during the winter of 1931-32.

Better Lespedezas[1]

As a result of selection work by several of the State Agricultural Experiment Stations and the Division of Forage Crops and Diseases of the USDA, several new strains of annual lespedeza have been developed.

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

Climax, a new variety selected from Korean, is adapted as a hay variety. It has proved to be about two weeks later in maturity than Korean and should be valuable in lengthening the pasture season. Other new strains have also shown high yielding ability.

Annual Hays Important In Feed Production[1]

Barley and hairy vetch produced more hay than any other combination of small grain and winter legumes in experiments in the lower Piedmont and Coastal Plain.

The experiments included seeding combinations of (1) oats and vetch, (2) oats and Austrian winter peas, (3) oats and crimson clover, (4) oats, vetch and peas, (5) oats, wheat and vetch, (6) oats, barley and vetch, and (7) barley and vetch.

Oats produced greater yields in combination with crimson clover than with any other of the legumes included, and yields from the oats and Austrian winter peas were less than from any other oat and legume seedings.

The yields of barley, when seeded in combination with winter legumes, were larger than from any other seeding. A combination of either barley and oats or wheat and oats produced more hay than oats alone, winter legumes being included in all cases.

The Norfolk fine sandy loam soil of the Coastal Plain produced twice as much as did the heavier soil of the Piedmont, however, the alfalfa from the two locations was more nearly equal.

Seeding Sudan grass or sorghum with soybeans or cowpeas greatly increased the total yield of hay over the legumes alone during the summer of 1943. The seeding combination of 30 pounds of soybeans and 30 pounds of sorghum produced nearly 4 tons of hay per acre on land that was planted to a hay crop during the preceding winter (Fig. 22). The total yield for the winter and summer hay crops on the same land was approximately five tons per acre for the best seeding combinations. Even though it is recognized that sorghum does not produce

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 22. LEFT, TWO BUSHELS OF BARLEY AND 15 POUNDS OF HAIRY VETCH PRODUCED 3,482 POUNDS OF HAY. RIGHT, TWO BUSHELS OF OATS AND 20 POUNDS OF AUSTRIAN WINTER PEAS PRODUCED ONLY 2,376 POUNDS OF HAY PER ACRE. PLANTINGS IN JOHNSTON COUNTY, SPRING OF 1943.

FIG. 23. SUDAN GRASS AND SOYBEANS PRODUCED 5,605 POUNDS OF HAY PER ACRE ON LAND PREVIOUSLY PLANTED TO SMALL GRAINS AND WINTER LEGUMES FOR HAY. THE TOTAL ANNUAL YIELD WHEN PLANTED IN FALL TO BARLEY-VETCH AND IN SPRING TO SUDAN GRASS-SOYBEANS WAS FOUR TONS PER ACRE.

an excellent quality of hay, it is used extensively in some areas because of its yielding capacities.

Adding soybeans or cowpeas to Sudan grass did not increase the yield for this particular year over Sudan grass alone. In every case, the yield of Tift Sudan was approximately 2½ tons of forage on the Coastal Plain soil and 3 tons on the Piedmont soil regardless of whether seeded alone or with legumes.[1] While pure seedings of either soybeans or cowpeas produced a better quality of hay, the yield was only slightly more than one ton per acre (Fig. 23).

The Sudan grass and sorghum were better adapted to the heavier Pied-

[1] See 1942 volume of Research and Farming for a description of the superior characteristics of Tift sudan grass.

FIG. 24. AYRSHIRE HEIFERS GRAZING BETWEEN ROWS OF BLACK LOCUSTS.

FIG. 25. TWO AYRSHIRE AND ONE JERSEY HEIFER GRAZING BETWEEN LOCUST ROWS.

mont soil, whereas, the summer legumes produced larger yields on the sandy Coastal Plain soil.

Embryo Development Unusual In Dallis Grass[1]

Not only is pollen abnormal in Dallis grass, as reported in 1942, but embryo (germ) formation also follows an unusual pattern. Present results are not complete enough to determine the exact nature of embryo and seed development. But it can be said that the usual methods of breeding are not likely to be successful in the improvement of this grass.

From the observations already

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

made, it seems wise to continue the study of seed development under the lenses of the microscope. For thorough understanding of the details of pollination and the origin of the embryo is necessary before efficient methods of creating new varieties can be devised.

Nitrogen Increases Sudan Grass Yields

The yield of Tift Sudan grass was increased 200 per cent by 50 pounds of nitrogen per acre in a preliminary experiment in 1943. Higher rates did not materially increase the yield in a season that was characterized by a drought when the crop should have been making its more efficient use of the nitrogen.

Black Locusts and Pasture Go Together

Erosion control, grazing, fence posts, and shade in the pasture are gained by planting black locusts in rows twenty feet apart and five feet apart in each row. Such a planting at the Piedmont Dairy Research Station, Statesville, is developing and a good turf is forming between the rows. It was used as a supplementary pasture this year and produced 378 cow days grazing (Figures 24 and 25). No supplementary feed was given. From present indications it will be possible to harvest a number of posts each year in the near future.

PEANUTS AND SOYBEANS

Variety and Fertility Combinations for Sandy Soils

A problem of great importance to peanut growers is that of choosing the most suitable combination of variety and fertilizer treatment. This is particularly true on light sandy soils of low fertility. To study this problem, four experiments were conducted during 1943.

The varieties compared were: Virginia Bunch, Improved Spanish (2B), White Spanish, and N. C. Runner. The fertilizer treatments were: No treatment (Check), 400 pounds landplaster per acre, 75 pounds muriate of potash plus 400 pounds landplaster per acre, and 400 pounds dolomitic lime plus 75 pounds muriate of potash. The landplaster was applied to the leaves at the early blooming stage. Potash was applied on the row as the peanuts emerged. Limestone was applied in the row just before planting.

Graphs showing the yields of Virginia Bunch and Spanish are presented in Figures 26 and 27. The principal results of these experiments can be summarized as follows:

1. Virginia Bunch when properly fertilized outyielded N. C. Runner and White Spanish. When landplaster was not added to these sandy soils, however, the Virginia Bunch failed more completely than did any of the other varieties. In this respect, N. C. Runner is closely related to Virginia Bunch. The Spanish varieties did best on the soils highest in organic matter.
2. Improved Spanish (2B) yielded high in all tests, exceeding Virginia Bunch at two locations. Seed stocks of this strain of Improved Spanish are not available in quantity at the present time. There is no assurance that yields of many of the so-called "Improved Spanish" peanuts will be as much superior to White Spanish as these tests indicate.
3. For all varieties except Spanish the two best fertilizer treatments at all locations are potash plus

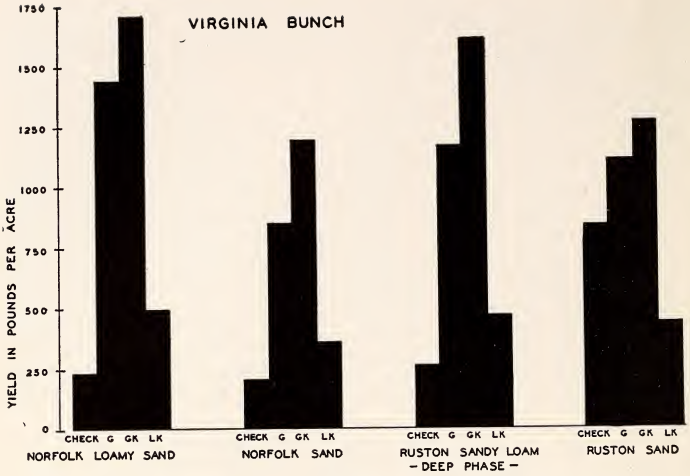


FIG. 26.

landplaster and landplaster alone. Of these two, the potash-landplaster combination was better in three of the experiments.

4. The limestone and potash combination is as good for White Spanish as the landplaster-potash combination.

On the basis of the best information available, growers in the new peanut belt are advised to try Virginia Bunch instead of the small White Spanish. Topdressing the plants with 75 pounds muriate of potash at emergence and applying at least 400 pounds per acre landplaster to the foliage at the time of blooming is recommended. On soils of low fertility and low calcium level, Virginia Bunch should not be grown unless landplaster is added.

For growers who plant Spanish, an application of 400 pounds dolomitic lime in the row and 75 pounds muriate of potash at emergence is recommended.

Available Calcium Is Necessary for Good Peanuts

The element calcium, commonly added through landplaster, potash lime, or one of the limestones, is necessary for good filling of peanuts. Furthermore, it must be present in the soil where the peanuts develop. In an experiment on deep phase Norfolk fine sandy loam, only nine per cent of the kernels were filled when no calcium had been added. This was raised to 49 per cent by the application of 400 pounds landplaster to the foliage. When the same quantity of landplaster was added to the rooting zone, only nine per cent of the kernels were filled. The natural calcium level of this soil was very low, equivalent to only 600 pounds of lime per acre.

If the original calcium level of the soil is high, added calcium may have no effect. In one experiment field at the Upper Coastal Plain Branch Station, for example, the soil contains a

quantity of calcium equivalent to 2,440 pounds lime per acre, and on this soil the addition of calcium had no effect. Peanuts developed equally as well without landplaster as with it. These experiments illustrate how each field presents a separate problem and show the value of soil analysis for peanuts.

Applying Potash To Peanuts

Six years' data accumulated from cotton, peanut, soybean rotation experiments at five locations show without exception that yields of peanuts are equally as high when cotton receives all the potash as compared with splitting the potash fertilization equally between the cotton and peanut crops. (Fig. 28.)

On light sandy soils of low fertility, however, where the previous crop has not been heavily fertilized, potash alone or with phosphate can be added directly to the peanut crop.

Six possible methods of adding 300 pounds of 0-10-10 per acre were compared in 1943 at three locations. On some of the plots the fertilizer was broadcast, one application being made to the cover crop in February and another just before the cover crop was turned in late March. One application was made in the row at the time of planting, one by the "Once-over machine" which placed the fertilizer in bands at each side, and one by a topdressing at emergence. At two of the locations there were additional plots where the fertilizer was placed on the plow sole. It was concentrated in a layer approximately 6 inches below the surface of the ground.

This study showed that no decrease in stand resulted from any of the methods. Furthermore, yields were not affected by the different methods of application.

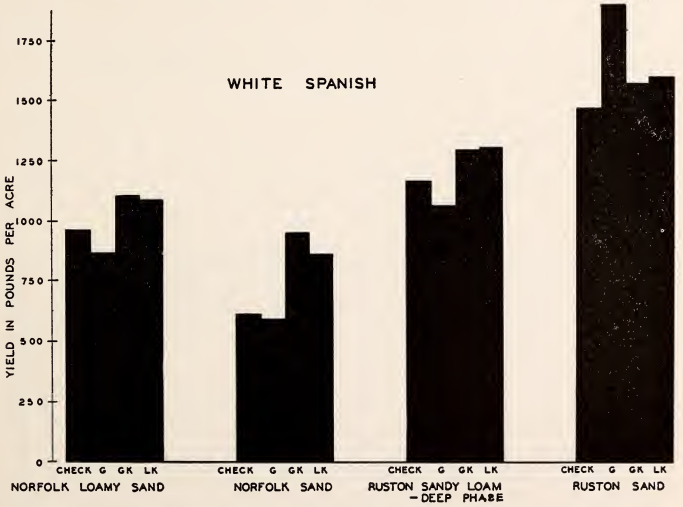


FIG. 27.

FIG. 28. PEANUT FERTILIZATION IS STUDIED IN A COTTON-PEANUT-SOYBEAN ROTATION AT THE U. C. P. BRANCH STATION, ROCKY MOUNT.

Peanut Varieties for Different Sections

The average yields of 20 tests conducted in Edgecombe, Halifax, Bertie, Northampton, and Perquimans counties from 1939-1943 show the Martin County Runner produced 90 pounds per acre more than the best Virginia Bunch strains, and 150 pounds more than the best Jumbo Runner strains.

In addition to a larger gross yield, medium runner peanuts have a higher shelling percentage than Virginia Bunch and Jumbo Runner strains. The farmer who plans to sell oil mill stock should keep in mind this larger total yield and higher shelling percentage.

Medium runner peanuts are harder to keep free from grass and weeds than are Virginia bunch types, however, and so farmers who are using a satisfactory Virginia bunch strain are not advised to change unless they can handle the more difficult cultivation of the runners. These also bring a lower price in the edible trade because of their smaller size.

The only place where Jumbo runners have consistently equaled or led in yields has been Perquimans County. Therefore, these peanuts are recommended only in the northeast section of the peanut growing area.

Spanish peanuts have been under consideration since the beginning of the war for their oil production. In spite of their higher shelling percentage and oil content, their yields are so much lower than other varieties in the Old Peanut Belt that their use is not advocated there.

In the new peanut areas, the Spanish strains have sometimes outyielded other varieties, and the Improved Spanish strains have very consistently shown higher yields than the small White Spanish.

Where it is definitely known that Virginia bunch peanuts do not produce well, or on very sandy soils where nothing is known of peanut

yields, it would be well to consider seriously the use of Improved Spanish types rather than Virginia bunch.

Spacing Recommendations Stay the Same

The results of experiments conducted in 1940, 1941, and 1942 showed that Virginia bunch peanuts were able to use rows as wide as 42 inches and use almost completely skips in the drill up to 24 inches.

The 1943 results were quite different because of weather conditions. The first part of the season was very favorable and a crown crop of peanuts was set. During the latter part of July, the weather became very dry and remained so for the rest of the fruiting season. As a result, no more fruit was set after the crown crop so that yields were determined early in the season when the plants were small. Because of the small size they were unable to use spacings as wide as they had in the past and maximum yields of Virginia bunch peanuts were obtained in 24-inch rows. As was expected, Spanish peanuts used even narrower spacings than bunch peanuts, increasing in yield down to the narrowest spacing or 18-inch rows.

Early Planting Gives Best Yield

Early planted peanuts for the fourth straight year outyielded those planted later. Actual tests show that those peanuts planted in early June have produced on the average only 65 per cent as much as those planted in April. The reduction of peanuts planted in May is not as great but is still a considerable loss.

Seed treatment gave better stands and better yields in the 1943 experiment. This test was made on the date-of-planting test so that the effect of seed treatment at each of the planting dates might be known. (Fig. 29.)

Contrary to what might be expected, the seed treatment gave more protection and increased yields on the later plantings more than on the earlier ones. This may be because the

FIG. 29. PEANUT PLANTING ON JULY 7, 1943. IN THE FOREGROUND IS A MAY PLANTING. IMMEDIATELY BEYOND THIS IS A JUNE PLANTING, AND BEYOND THIS AN APRIL PLANTING FOLLOWED BY ANOTHER JUNE PLANTING.

seed rotting organisms become much more active under the warmer temperatures at the later planting dates.

Harvest Peanuts On Time

In work done to determine the effect of time of digging on yield, it was found that yields were at an optimum at the time they are normally considered mature.

The average increase in yield for delaying digging from the first week in September until the third week was about 40 per cent or 500 pounds per acre. On the other hand, delay of three more weeks decreased the yield about 200 pounds per acre.

The shelling percentages were, however, higher for the later dates than for the earlier ones.

How Does a Peanut Become a "Pop"?

Peanuts are queer plants. They resemble other legumes in many ways, but the pods and seeds are produced underground. The bright yellow flower of the peanut looks much like the flower of a pea or bean. But the ovary, the flower part which later develops into the pod, is not enclosed by the petals as in the bean. Instead, it is located in the leaf axil at the base of a tube that supports the yellow petals and other flower parts. (Figures 30 and 31.) The ovary contains two, sometimes three or more ovules, minute organs containing the egg cells. When these egg cells are fertilized, following self-pollination, embryos are produced and each ovule with its embryo develops into a seed.

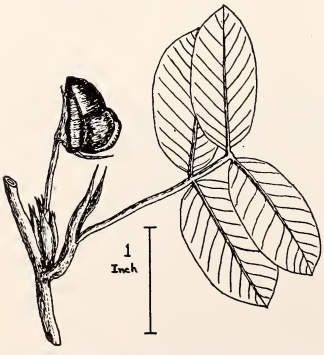


FIG. 30. PEANUT FLOWER AND BUDS AS THEY OCCUR IN THE LEAF AXIL.

On a bright summer day the new flowers open shortly after sunrise. By sunset, the flower is wilted except for the ovary in the leaf axil. Meanwhile, the anthers have released their pollen, and pollen tubes have grown down the slender style to the ovary. By the end of the day, the ovules are reached and the egg cells are being fertilized.

During 1943, microscopical studies of these processes in peanuts have shown that the egg cells are produced and united with the male cells from the pollen just as in many other legumes.

Following the union of the male and female cells, the development of the peanut is unique. This ovary does not immediately become a pod. During the first week it grows slowly forming a sharp pointed tip like that of a root. A stalk develops below the ovary which bends, and by growing very rapidly, forces the tip into the ground. The "peg" (botanists call it a gynophore) often reaches a length of four to six inches. The ovules are found in the tip of the peg and grow very little as long as they remain above ground.

After the tip is an inch or more below the soil surface it begins to enlarge and grows into the familiar peanut pod. At the same time the embryos enlarge rapidly, storing oil and starch which will nourish the future seedlings. (Fig. 32.)

Most of these basic facts on peanuts have been known to peanut growers

and to plant scientists for some years. Recently, however, farmers and experimental workers have been asking what happens when large type peanuts form pops. Pops are well developed peanut pods in which the seeds are small and shriveled or absent altogether.

From the present microscopical study, it is known that peanuts develop normally up to the time the egg and the male cell unite. Therefore, the pop condition must arise during the development of the embryo into the mature seed. Further microscopical work, in which the developing pods and embryos of pops are compared with those of normal peanuts, is expected to answer this question.

Treating Peanut Seed With Different Materials

Two new materials, DuBay 1452-C and Spergonx, appear promising in treating peanut seed but are not rec-

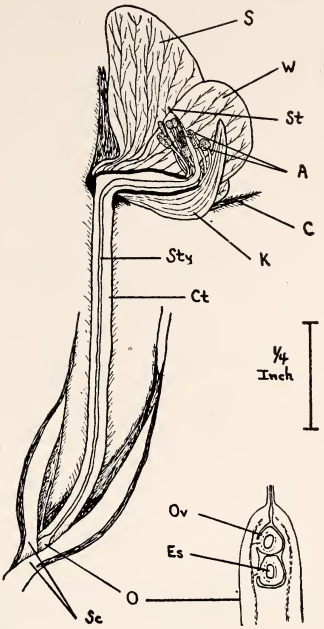


FIG. 31. DIAGRAM OF PEANUT FLOWER: S, W, AND K ARE FLOWER PETALS; ST, STIGMA; A, ANTHERS; C, CALYX; STY, STYLE; CT, CALYX TUBE; OV, OVULE; ES, EMBYRO SAC CONTAINING THE EGG CELL; O, OVARY; SC, BUD SCALES.

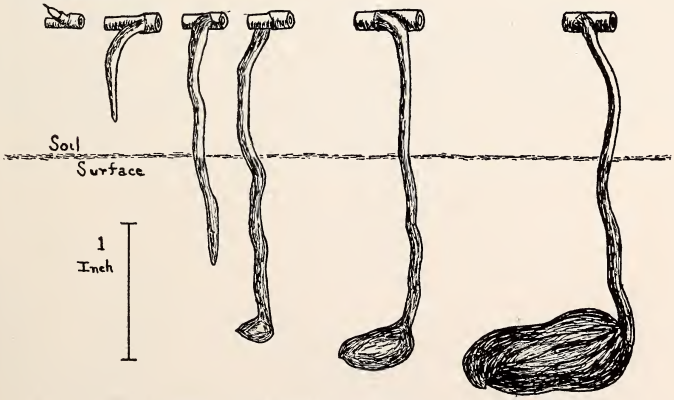


FIG. 32. SIX STAGES IN THE DEVELOPMENT OF A PEANUT PEG; OVARY TO MATURE POD: LEFT TO RIGHT.

ommended at the present time because they have been tested only during one season.

The four materials recommended in 1943 for treating peanut seed, Arasan, 2 per cent Ceresan, Yellow Cuprocide, and Spergon, were included in a number of the tests in 1943 so that their effects on emergence could be measured separately.

The results show that each of the four materials recommended for treating peanut seed increases stands significantly. Untreated seed only germinated and emerged in 54 per cent of the cases. Arasan, 2 per cent Ceresan, and Yellow Cuprocide appeared to be about equally effective, giving an average emergence of 75 per cent. Spergon was consistently the least effective with 68 per cent emergence, and, therefore, will not be strongly recommended in 1944.

Results on the rate of applications showed that high rates did not increase emergence over the intermediate or standard ones. Emergence of seed receiving the low dosages was in all cases less than from that receiving the intermediate ones.

Machine Shelling and Seed Treatment Offer Substantial Savings To Peanut Growers

In a series of tests with the Virginia bunch variety of peanuts in 1943, in which hand shelled and machine shelled seed were compared, it was found that the emergence of untreated hand shelled seed was better than untreated machine shelled with only one exception. Only small differences in germination were obtained with the two types of seed when treated, although the hand shelled did hold a slight advantage over the machine shelled. From these and similar results, it appears that peanut growers can machine shell and treat their peanut seed and expect satisfactory stands.

The cost of hand shelling seed to plant North Carolina's peanut acreage is about $300,000 annually. This seed could be machine shelled at a cost of about $150,000 and treated at a cost of about $25,000, thus bringing a savings to the growers of about $125,000 annually.

Peanut Seed Treatment In Relation To Date of Planting and Time of Treatment

Suitable lots of hand and machine shelled seed of the Virginia bunch variety were treated with Arasan, 2 per cent Ceresan, Yellow Cuprocide, and Spergon, at 3, 4, 4, and 4 ounces per 100 pounds, respectively. All treatments were made one to two days before planting. Duplicate experiments were planted on the Upper Coastal Plains Test Farm on April 16, May 5, and June 3. Stand counts and yield records showed the following: (1) Germination of the seed decreases as the date of planting is delayed, the decrease being particularly sharp at the late planting. (2) This drop in germination is partially, but not entirely, prevented by seed treatment. (3) Yields, like germination, decreased as the date of planting was delayed. This is in agreement with the results of agronomic tests conducted over a period of years. (4) Decreased stands are not wholly responsible for decreased yields at the later plantings, although they undoubtedly are partially responsible.

Suitable lots of hand and machine shelled seed of the Virginia bunch variety were treated at intervals of 81, 60, 30 and 3 days before planting. The seed were stored in a building without heat. Emergence of seed in this test was strikingly similar for a given treatment regardless of when the seed were treated. From this experiment it is concluded that peanut seed, of the variety studied, can be treated and stored with safety for

any reasonable period of time before planting. Such storage does not appear to increase or decrease the effectiveness of any of the treating materials. In practice it is recommended that the seed be treated at least one day before planting to permit action on surface-borne organisms before possible dilution of the materials in soil moisture.

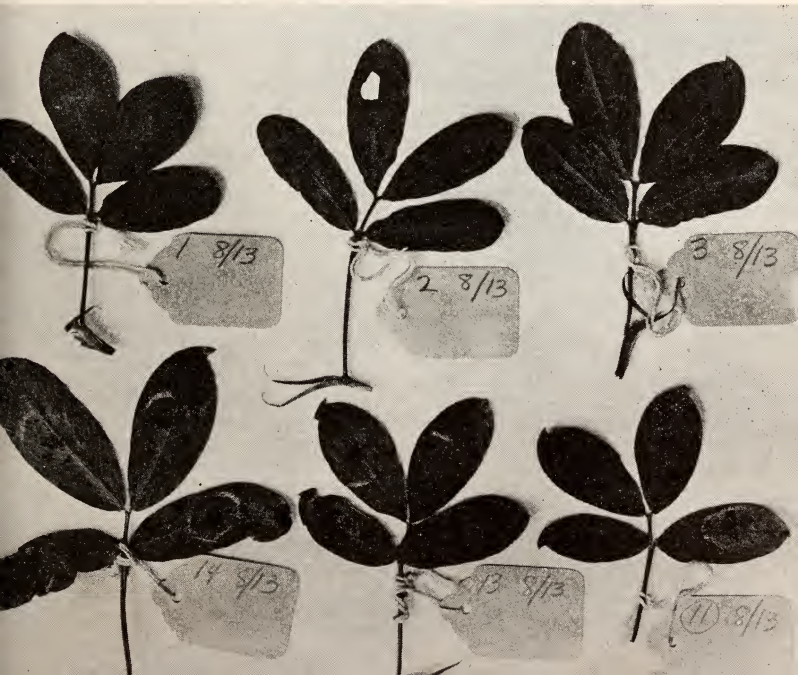
How Cercospora Leafspot Fungi Of Peanuts Behave

Cercospora leafspots of peanuts develop to a severe stage much earlier, particularly on the lower leaves, on peanuts following peanuts than on those following other crops, as indicated by systematic counts during the 1943 season.

Sclerotic tissue of the leafspot fungi overwinter on old diseased leaves and stems in the soil and appear to give rise the following spring and summer to conidia (spores) which infect the young peanut plants. In one experiment, soil was taken from an old peanut field and sprinkled in the row just before peanuts were planted in a field where they had not previously been grown. Leafspot appeared much more abundantly where the "peanut soil" had been added, giving further evidence of the overwintering of these organisms in the soil.

Since the spread of infection depends upon the supply of conidia, a knowledge of the conditions determining their formation is important. The first leafspots were noticed at the Upper Coastal Plains Test Farm, Rocky Mount, in late May, and conidial formation on the infected leaves was observed in the field on June 8.

FIG. 33. PEANUT LEAVES THAT WERE INOCULATED WITH THE "EARLY" LEAFSPOT FUNGUS. UPPER THREE RECEIVED AN APPLICATION OF A 6 PER CENT COPPER-SULFUR DUST JUST BEFORE INOCULATION; LOWER LEAVES DID NOT. NOTE PREVENTION OF INFECTION BY THE DUST TREATMENT.



Conditions favoring the abundant formation of conidia are: (1) damp, warm weather, following rains; and (2) periods of heavy dew. Rains wash most of the conidia off into the soil and make them unavailable for distribution by wind and insects. New crops of conidia are formed approximately every 24 hours. During exceedingly dry weather without nightly dews, the formation of conidia is greatly reduced.

The conidia are dislodged and distributed from plant to plant by wind, insects (particularly leafhopper), and by water currents which flood the middle of rows. Peanuts planted in a broom straw field and in woods at intervals of about 50 yards up to 200 yards from the nearest peanut field, and that are kept covered with cages to exclude animals and all but the smallest insects, became infected by the leafspot fungi, indicating that the conidia are carried some distances either by wind or insects.

Field inoculation tests of any size had not previously been carried out because of the difficulties in securing a sufficient supply of inoculum. It was found, however, that if leaves with well-developed spots were kept in deep chambers 18 to 24 hours, conidial formation was greatly increased. By washing the conidia from such leaves, inoculum was secured in sufficient quantity for use in a quart size spray which made the inoculation of plants in a quantity easier. Conidia were equally effective if applied dry, by touching the surface of an uninfected leaflet with a conidial-bearing leafspot.

Using both wet and dry inoculum in field tests it was found: (1) that the incubation period for the early leafspot fungus *(Micosphaerella arachi dicola)* was 7 to 10 days, while for the late leaf spot fungus *(M. berkeleyii)* was 12 to 20 days; (2) that the inoculum is capable of causing infection under practically all weather conditions in the field even where the inoculated plants are uncovered; (3) that there was no difference in the susceptibility of young and old plants or of young and old leaves; (4) that the Spanish types are more susceptible than the Virginia bunch; (5) that inoculation followed by dusting immediately and up to 8 days gave practically 100 per cent control (Fig. 33); but if the time of dusting after inoculation was delayed longer, leafspot developed, indicating that dusting is not effective in preventing the development of a leafspot after the fungus has entered the leaf tissues. Other artificial inoculation experiments conducted to test the length of time the dust remained effective showed that infection was prevented as long as two weeks after dusting.

Seeking Method for Treating and Inoculating Peanut Seed

The question has frequently been raised as to whether bacterial inoculation of peanut seed is compatible with the recommended seed treating materials, and if both should be applied to the seed. Lacking specific information on the problem, a preliminary experiment involving seed treatment and various methods of bacterial inoculation was conducted with hand shelled Virginia bunch seed in 1943.

Duplicate tests were conducted at two locations, one on land where peanuts had previously been grown, and the other on land where they had not been grown. Three methods of inoculation were used: (1) application of commercial inoculum to treated seed; (2) soil, taken from a field where peanuts were grown in 1942, was sprinkled in the row just ahead of planting at the rate of about five bushels per acre; and (3) commercial inoculum was mixed with virgin soil, in the proportion of about one pound to five bushels of soil, and the mixture

sprinkled in the row just ahead of planting. The seed were also treated with four seed-treating materials.

None of the inoculation treatments significantly increased peanut yields at the place where peanuts had previously been grown, indicating that this soil carried a sufficient amount of natural bacterial inoculum. At the location where peanuts had not previously been grown, significant increases in nodulation and yields did not occur when the inoculum was applied directly to the treated seed. However, definite increases in nodulation and yields resulted from the addition of naturally and artificially contaminated soils to the row just ahead of planting. Seed treatment did not appear to interfere with nodulation when these methods of inoculation were used.

Seed Treatment Studies In Relation To Spanish Peanuts

Several experiments, in which various seed treatments were given to unshelled, hand shelled, and machine shelled seed of the Spanish variety to measure their effects on germination have made possible the following general conclusions to date:

(1) Unshelled and untreated seed of the Spanish variety can be expected to germinate, on the average, around 35 to 40 per cent. (2) This germination can be increased, on the average, about 15 per cent by soaking the seed in water for 24 to 48 hours before planting. The addition of a seed-treating material to the water gave little or no benefit. (3) Dusting of unshelled seed with any of the standard seed treating materials gave only small increases in germination. (4) Hand shelled and machine shelled seed treated with Arasan at the rate of 3 ounces per 100 pounds gave 80 to 85 per cent germination, which was about twice as good as the germination of treated, unshelled seed.

Therefore, the recommendation is that farmers planting the Spanish variety of peanuts should shell and treat the seed or make a very heavy seeding of unshelled seed if they expect to get a stand.

Ogden and Volstate Soybeans Outstanding[1]

Ogden and Volstate soybeans continued to stand out in the yield trials this year. They are high yielding, fairly shatter resistant, have high oil content, small stems and stand up well for combining.

As the Ogden matures in early October and Volstate about three weeks later, these two varieties will be very satisfactory for the grower who wants an extended combining season. Furthermore, there is no longer any excuse for North Carolina growers to be penalized for low oil beans as *these varieties are as high in oil as the midwestern varieties.*

Arksoy yields about the same as Wood's Yellow but has a higher oil content and is more shatter resistant *if pure seed are used.* Early Wood's Yellow, Ralsoy, and Arksoy 2913 have the same plant type, oil content and yielding ability as the Arksoy.

In tests following strawberries or potatoes there was little difference in yield between early and late maturing varieties. Under favorable conditions soybeans following highly fertilized crops will yield well without the application of additional fertilizer. For instance, at Willard, Ogden yielded 31 bushels per acre when planted in mid-April and fertilized with 400 pounds of 2-12-6. In an adjoining field, Ogden yielded 27 bushels without fertilization following a strawberry crop.

---

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

Hormone Seed Treatment for Soybeans Ineffective[1]

Two commercial hormone powders, Staleymone and Rootone, were tested to see if they might stimulate the yield of soybeans. Tests were conducted on three varieties and at eight locations. Growth responses during the season gave no indication of any effect, and the yield of beans with one exception showed no response to hormone treatment. At Willard following strawberries, Staleymone gave a slight increase on two out of the three varieties. In no case did Rootone give an increased yield.

Should Farmers Inoculate Soybeans?[1]

Soybeans, like other legumes, to grow normally without nitrogen fertilizer require the presence of nodule forming bacteria in the soil. On fields where soybeans have never been grown, these bacteria must be put in the soil.

However, these bacteria live in the soil a long time once they are introduced, and additional inoculation gives no response. Nine inoculation tests have been run during 1942 and 1943. Some were on fields that had not grown soybeans for at least eight years. In each case, the uninoculated plots produced an abundance of nodules and made as good growth and yields as the inoculated plots.

Inoculation is good insurance where the grower is not sure, but it is a needless expense when he has grown soybeans successfully on that soil within the past six or eight years.

Bacterial Diseases Increasing On Soybean

Diseases which attack soybean leaves and at times cause considerable defoliation are prevalent in North Carolina (Fig. 34). The bacterial pustule disease can be found in one-half or more of the fields. The bacterium which causes this disease survives the winter season in dead, diseased leaves and in a portion of the seeds coming from diseased plants.

Soybean leaves collected from a diseased field in 1942 and kept over winter served to start the disease when scattered along rows of beans planted in 1943. The bacterium that causes this disease was isolated from leaves collected from several fields in 1943 and also from seeds harvested in the fall of 1943. Seed treatment tests failed to prevent occurrence of the disease on plants that grew from the treated seeds.

To avoid this disease the grower should try to obtain seed from fields that had little or none of the disease, or he should use varieties that are resistant. Observations made on variety tests at several locations in 1941, 1942, and 1943 show certain varieties to be much more resistant than others to damage by this disease. Ogden, Otootan, Palmetto, and Woods Yellow have shown considerably less damage from bacterial pustule than varieties such as Tokio, Herman, Mammoth Yellow, or Arksoy.

In certain soybean plantings, and often accompanying the bacterial pustule disease, a second bacterial leaf spotting disease was found in 1942 and again in 1943. The causal organism was isolated but has not yet been fully identified. It seems under some conditions to be even more destructive than the bacterium causing the pustule disease.

Sidedressing Soybeans with Potash

Recent experimental work has shown that potash deficiency is a major fertilizer problem with soybeans in the Coastal Plain.

This is particularly true on the dark soils high in organic matter. As a

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

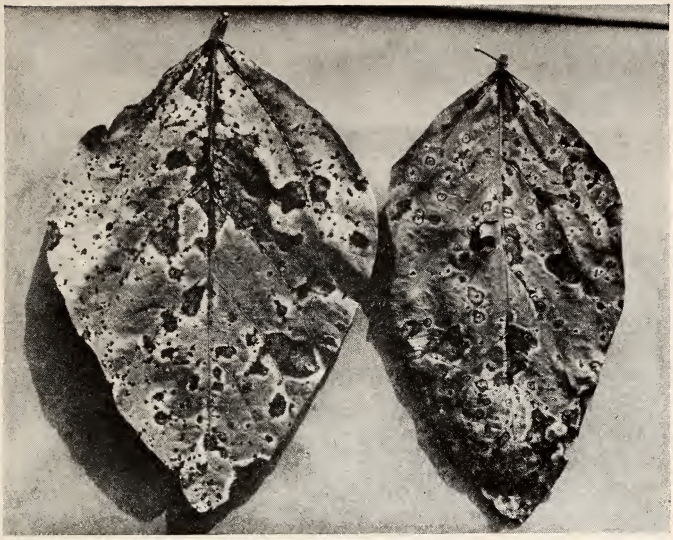


FIG. 34. BACTERIAL LEAFSPOT ON SOYBEAN.

rule, corn in rotation with soybeans on these soils is not heavily fertilized. In these cases, the sidedressing of 75 to 100 pounds muriate of potash per acre has resulted in yield increases of 5 to 8 bushels per acre.

At the particular places selected for experimental work, there was no response from added phosphate or lime and high rates of lime were found to decrease yields. Light applications of lime, however, will supply the necessary calcium and magnesium without an unfavorable effect on potash absorption.

SMALL GRAINS

Early Seedings of Oats, Wheat, and Barley Make Higher Yields

Small grains seeded after November 1 have not produced yields equal to those from grains seed earlier in experiments conducted during the last two years at the Piedmont Experiment Station near Statesville.

Oats seeded October 1, produced an average of 66.9 bushels per acre compared with only 34.7 bushels when seeded November 15. In seasons when winter killing of the small grain plants and heaving of the soil are severe, late seeded oats are reduced in both stand and yield more than the earlier ones. Complete crop failures for the November 1 and November 15 seeding of oats were recorded for the 1943 crop season.

Wheat seeded October 15, has pro-

duced 27.2 bushels per acre while that seeded one month later, November 15, has produced 21 bushels or slightly over three-fourths as much.

Barley seeded on October 1 has produced 39.8 bushels while that seeded six weeks later produced only a little less than three-fourths as much, or 28.8 bushels per acre (Fig. 35).

Furthermore, late seedings make very little fall growth to protect the soil from the impact of winter rains, and a very small root system to anchor the soil and absorb nutrients that may be in solution. Thus, erosion and leaching may be stepped up instead of controlled.

Rate of Seeding Wheat, Oats, and Barley

Wheat seeded at the rate of six pecks per acre has produced an increase in yield great enough over that produced from four pecks to lead to the recommendation of seeding from five to six pecks per acre. Seeding at rates higher than six pecks have not increased yields.

Oats seeded in the fall at rates

FIG. 35. DATE OF SEEDING SMALL GRAINS AFFECTS AMOUNT OF WINTER COVER.

TIME OF APPLICATION OF NITROGEN TOP-DRESSING AFFECTS YIELD OF WHEAT

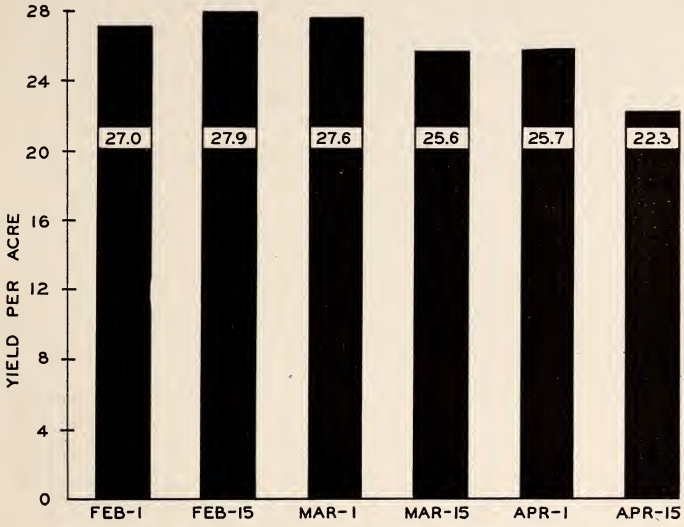


FIG. 36.

greater than two bushels have not produced any larger yields.

Barley seeded at the rate of two bushels per acre has increased the grain yield over the 1½ bushel rate, but rates higher than two bushels are not worthwhile.

Wheat Responds To Spring Nitrogen Top-dressing

Wheat responded to top-dressings of nitrogen in eight out of nine experiments during the 1942-43 season. This group of experiments included a fairly wide range of soil conditions, sandy loams, clay loams and silt loams.

Increases from 2.9 bushels per acre to 11.1 bushels, with an average of 6.8 bushels, were obtained from the first twelve pounds of nitrogen (75 pounds of nitrate of soda). The smallest increases and the one field that did not respond were following heavy crops of legumes incorporated with the soil.

Small Grain Following Heavily Fertilized Crop Responds Less To Phosphate and Potash

Small grains respond less to phosphate and potash following heavily fertilized crops, like cotton and tobacco, as indicated by experiments conducted during the 1943 season. The largest responses to phosphate and potash were following corn, small grain and hay crops, all of which re-

ceived relatively small amounts of commercial fertilizer.

The graph in Figure 36 suggests that nitrogen applications in excess of those made in a complete fertilizer at seeding are lost by leaching before the plants can use it. In the very late application, April 15, the plants are approaching maturity, therefore fail to use the supply of nitrogen.

Grow Barley On Fertile, Well-Drained Soils

As barley is more sensitive to certain soil conditions than wheat or oats, and should be restricted to the more fertile, well-drained soils, such soils were selected for the tests reported herein.

In the winter of 1942-43 there were on test on the Piedmont and McCullers Branch Stations, 49 varieties and strains; eight of the more promising of which were included in the six Official Variety Tests. The 1942-43 results, together with those of previous years, point out the better yielding varieties for each area. As an average of 10 tests in the Piedmont, Sunrise (awnless) has produced approximately 52 bushels per acre; Davidson (bearded), 50; Randolph (bearded), 49; Iredell (hooded), 40; and Tennessee No. 8 Hooded, 34.

A similar number of tests conducted in the Coastal Plain have given the same relative ranking for these varieties with the exception of Davidson and Randolph, which are reversed. In this general area, however, there have been several failures reported for Sunrise, which raises a doubt as to its range of adaptation. On the other hand, comparative data available do not show this variety to be any more subject to change in conditions than other varieties in the tests, with the possible exception of that from the Lower Coastal Plain.

Sunrise has good resistance to mildew and from tests made at the Mountain Branch Station in the fall of 1943 it seems to be one of the most resistant varieties in the nursery to aphids. These insects did a great deal of damage to grain crops during the fall of 1943 and the resistance of Sunrise may be of real importance in years to come. Sunrise, Iredell and Davidson should be grown more generally throughout the state.

Chinch Bug Control Under Study

During the past two years several areas have reported outbreaks of chinch bugs. In the fall of 1943 observation nurseries were planted in two of the worst infested areas, Mecklenburg and Pitt counties. For these tests, 15 resistant varieties from the Division of Cereal Crops and Diseases and 5 local varieties were used.

While awaiting results from these tests, certain cultural practices are suggested for areas where chinch bugs may be found. The simplest precaution to be followed is to separate barley, or other grain fields, as far as possible from areas where corn is to be planted. This is because after the grain crops are cut the insects migrate to corn and there inflict even greater damage. If such migration does take place, it may be necessary to use furrows with coal tar barriers. (Farmers interested in this type of control should write to the Extension Entomologist, State College Station, Raleigh, for instructions).

Grow Wheat Adapted To Your Area

In the Mountain area, Thorne produced the highest average yields during the past 5 years, with an average for the period of 34.0 bushels per acre as compared to 31.2 for Nittany. Thorne is a stiff strawed, brown chaff, awnless variety with good resistance to loose smut, developed by the Ohio Agricultural Experiment Station and now in commercial production. Ex-

tended trials with this variety are recommended.

In the Piedmont area, as an average of eight tests conducted in the past four years, Hardired has the highest production. Its yield was 37.5 bushels as compared with 33.6 for Redhart, 33.6 for Nittany, 33.4 for Carala and 31.4 for Leap.

Promising new strains in the Piedmont tests are certain selections from a cross of Nittany and Malakof. These are very similar to Nittany but carry good leaf rust resistance. Three were in the eight Piedmont tests referred to above and averaged 36.0 bushels as compared with 33.6 for Nittany. In the Mountain area, as an average for two years, they have yielded 26.8 bushels as against 22.8 for Nittany. One of these, Nittany x Malakof, strain 3, has shown excellent milling quality in cooperative tests with the Federal Soft Wheat Laboratory, Wooster, Ohio. This strain is being increased for possible release in 1945 as a rust resistant strain of the Fulcaster type.

Plant Cold-Resistant Oats

As the winter of 1942-43 was more severe on fall sown oats than any since 1936, the superiority of hardy varieties really stood out. Many selections were killed during the severe winter and so were eliminated from the testing program. However, this made possible a more critical selection of material from the breeding stocks.

Official Variety Tests conducted in the Mountain area for the past two years gave average yields from fall seedings of 80 bushels per acre for Letoria, 76 for Stanton and 62 for Fulwin, three of the hardier strains tested. Fulwin is the hardiest of the three and might stand through the winters at still higher elevations than the Mountain Branch Station at Swannanoa, where one of the two-year tests was conducted, or at Hendersonville, where the other test was run. At each of these points the elevation was slightly over 2,000 feet.

For these two years, Letoria produced more total digestible nutrients than did the best wheat or barley variety in the tests, and shows that it may be possible to seed these new, hardy varieties at the higher elevations. Further testing is necessary, but the results to date seem to justify rather widespread farm trials.

Throughout the Piedmont area, 1083 B_2-1, a selection from a cross of Lee x Winter Fulghum, Fulwin and Stanton gave the highest yields in 1942-43.

The highest average yields produced in five Coastal Plain tests conducted during the past two years were as follows: Stanton, 84.1; 1083 B_2-1, 81.6; Victorgrain 3, 80.9; and Letoria, 78.9. Other varietal yields ranged as low as 70.6 bushels.

While varietal yields differing by as much as 13.5 bushels are certainly worth while, these high average yields of all varieties suggest that yields in the state might be increased by greater care in the selection of suitable soils and by better cultural practices. The same holds true for all three crops, namely, wheat, oats and barley.

TOBACCO

Combination Blue Mold and Flea Beetle Spray

The addition of calcium arsenate to standard blue mold sprays was found to be effective in reducing flea beetle populations in plant beds. Protection from flea beetle infestation was also afforded the plants for a limited time after they had been set in the field. There was no evidence

that calcium arsenate had an injurious effect on the blue mold sprays.

Protection of Newly Set Tobacco Plants[1]

It was conclusively demonstrated that insecticides applied in the plant beds immediately before plants are set in the field will protect them from flea beetle infestation during the critical period when they are becoming established.

Basic copper arsenate, 1 part to 2 parts diluent, cryolite, 80 per cent Na_3AlF_6, and paris green-lead arsenate, 1-5, were all effective in this respect. Information available at the present time would indicate that preference should be given these materials in the order listed.

Reduction of Flea Beetle Populations In Plant Beds By Means of Soil Treatments[2]

Experiments demonstrated that fuel oil, such as is used for fuel in furnaces and space heaters, sprinkled on plant bed sites after the required plants have been pulled will effectively reduce the populations of flea beetles developing in these places. When used at the rates of 4, 8, and 12 gallons per 100 square yards the populations of flea beetles were reduced 87, 94 and 98 per cent, respectively. There was no evidence that the fuel oil caused any damage to such crops as corn, snap beans, soybeans, wheat or cowpeas planted in the treated areas.

Field Control of Hornworm Infestation[2]

An unusually heavy infestation of hornworms occurred during the season of 1943 and many farmers had difficulty in getting enough lead arsenate to meet their demands. In some cases cryolite was substituted. By checking and supervising control operations performed by farmers it was determined that cryolite, when used as a spray at the rate of 6 pounds per 50 gallons of water, gave satisfactory control. When used as a dust, however, the control was not satisfactory. Some farmers said that they obtained better results with the cryolite spray than with paris green-lead arsenate.

402, A New Variety of Tobacco[1]

Flue cured variety 402, developed from a cross of 400 and Jamaica has shown much promise in yield trials at the Tobacco Branch Station. This strain has also given good results in commercial trials by growers, producing high yields of good quality leaf in common with 401, but differing from this variety in a closer spacing of leaves on the stalk. The more compact growth habit of 402 is thought to make this strain less subject to being blown down by high winds. 400 and 401 have been enthusiastically received by tobacco farmers, and in many areas of the State are displacing the previously established varieties.

Tobaccos Resistant To Granville Wilt Show Good Quality In 1943 Tests[1]

Twenty acres of wilt contaminated soil at several locations in Granville, Pitt and Craven counties were planted in Granville Wilt Resistant Tobacco in 1943. Hybrids of T.I. 448A parentage showed less than 5 per cent wilt at places where standard varieties were a complete loss (Fig. 37).

In yield trials at the Tobacco Branch Station, the more productive selections produced 1,500 pounds of tobacco an acre valued on the 1943 market at $43 per 100 pounds, a yield

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

[2] Cooperation: Bureau of Entomology, Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 37. RESISTANCE TO GRANVILLE WILT. LEFT, A STANDARD FLUE-CURED VARIETY IS BADLY DISEASED. RIGHT, A HYBRID FROM A CROSS OF T.I. 448 A x 400 IS GROWING VIGOROUSLY.

and value that compared favorably with standard varieties.

Control of Granville Wilt By Soil Treatment with Uramon In Combination with a Corn Rotation[1]

A normal crop of fair quality leaf was grown on wilt contaminated soil by treating the land with 1,000 pounds of Uramon an acre and planting the field to corn for one year. Plots treated in the fall of 1941 and planted to corn in 1942, yielded 977 pounds of tobacco in 1943 that sold for $39.30 per 100 pounds. In a study of rates of Uramon when used in combination with the corn rotation, tobacco grown on plots treated with 250, 500 and 1,000 pounds per acre averaged, respectively, 63, 36, and 13 per cent wilt in tests on a total of 9 replicates at 5 locations.

Blackshank Resistant Tobaccos Widely Grown[1]

Approximately 3,000 acres of Oxford 1, 2, 3 and 4, the blackshank resistant strains recently released by the Tobacco Branch Station, were grown in 1943. Quality of the cured leaf was good even though seasonal conditions were generally unfavorable. Blackshank resistance was adequate except when grown under conditions

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 38. FARMERS USE BLACKSHANK RESISTANT TOBACCO. UPPER: A FIELD PLANTED IN ONE OF THE STANDARD VARIETIES SHOWING HEAVY LOSS FROM BLACKSHANK. LOWER: A FIELD PLANTED IN BLACKSHANK RESISTANT TOBACCO, OXFORD NO. 3, PRODUCING A NORMAL CROP.

favoring exceptionally severe disease development. In a few cases as much as 20 per cent loss of plants occurred, largely during the earlier part of the growing season. This loss was associated with growth of seedlings on blackshank contaminated beds or growth on fields where tobacco was badly diseased the previous year. Best results in both the quality of the crop and blackshank control were obtained where the resistant strains were grown on soil rotated to other crops for two or three years (Fig. 38).

New Spray Treatments for Blue Mold Control[1]

Blue mold was more severe in 1943 than in recent years and it was possible to obtain decisive results in experiments with new spray materials. In tests conducted on a commercial scale, bismuth subsalicylate and fermate sprays gave good blue mold control, equal or in some cases proving superior to the regular copperoxide oil mixture. Bismuth subsalicylate was used at the rate of 12 ounces in 50 gallons of spray together with 8 ounces of vatsal O.T.C. as a wetting agent. Fermate was used at the rate of 1 pound in 50 gallons of spray with or without a wetting agent.

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 39. YIELD AND SCAB OF NO. 1 SIZE TUBERS. LEFT: LIME 10 INCHES BELOW SURFACE OF THE SOIL; CENTER: LIME MIXED IN SURFACE 10 INCHES OF SOIL; AND RIGHT: NO LIME.

HORTICULTURAL CROPS

TRUCK CROPS

Placement of Lime May Be Important In Irish Potato Production

The problem of meeting the lime requirements of the Irish potato plant without making conditions favorable for severe scab infection is important to the Irish potato grower. Since the potato tubers develop in the upper few inches of the soil, there is a possibility that lime placed beneath the tuber zone, two to three inches below the plow sole, would help solve this problem. Such a procedure would leave the top soil acid, which is unfavorable for scab development, and at the same time, it would supply lime for plant intake.

The first work on this idea was conducted in the greenhouse where potatoes were grown on Portsmouth sandy loam inoculated with scab. These three treatments were compared: (1) no lime, (2) lime placed ten inches below the surface of the soil at the rate of two and one-half tons per acre, and (3) lime mixed in the surface ten inches of soil at the same rate.

Yields of No. 1 tubers were significantly higher in the treatment receiving lime placed ten inches below the surface than in either of the other two treatments. The scab infection of the tubers grown in either the lime below treatment or the no lime treatment was very low. When lime was mixed in the surface, however, seven per cent of the total surface of the tubers was covered with scab. The differences in yield and scab infection

of the tubers are shown in Figure 39. Plant height and calcium uptake were significantly greater in the lime below treatment.

To test further subsurface application of lime, two field experiments, to be continued at least three years, were begun in 1943 on soils known for their severe scab infestation. Because of seasonal conditions, however, there was practically no scab on either of the experiments the first year. Plant analyses show that calcium was absorbed from the limestone placed ten inches deep.

The first results from deep placement of lime for Irish potatoes are favorable from the standpoint of scab control and yield maintenance. Further experimental data will be obtained, however, before the practice is recommended.

Potassium and Calcium Fertilizer Studies On Irish Potatoes Continued

The preliminary work in 1942 on the effect of the amount of potassium and calcium in fertilizer on the yield and scab of Irish potatoes was continued in 1943. Two field experiments, to be conducted at least three years, were begun on scab infested soils in Eastern North Carolina. Fertilizers containing 2, 7, and 12 per cent K_2O with 0, 14, and 28 per cent CaO at each potash level were tested.

Because of seasonal conditions there was no scab on the potatoes from either of the experiments. There were also no outstanding differences in yields among the fertilizers at either location. This shows that these particular fields, on which potatoes had been grown every year for several years and had received approximately one ton of fertilizer annually, were well supplied with K_2O and CaO. Hence, to get the desired K-Ca balances in the soil and the true effects of the applied fertilizer on yield and scab, the experimental fertilizers will be applied to the same plots over a period of years.

Irish Potato Variety Studies In Eastern Carolina

Variety testing is fundamental to any program dealing with crop production. This is particularly true in North Carolina because of the varied topography, large number of soil types and differences in climate. In the Eastern part of the state alone, differences in climate and soil will be found north and south of the Albemarle Sound. All these factors have a bearing on the performance of Irish potato varieties.

For a number of years, from twenty to forty varieties and seedlings have been included in the tests but only a selected number are reported at this time (Fig. 40).

Three of these, Cobbler, Red Bliss and Chippewa have been planted by growers, but the other three, Red Warba, Houma and Pontiac, are new. Red Warba is earlier than Cobbler and, as the name indicates, red. Houma is a medium maturing white potato, and Pontiac, a late red.

It is of interest to note the difference in yields between Red Warba and Red Bliss. As a result of these tests, commercial growers and seedsmen will buy approximately four cars of Red Warba seed for planting in 1944.

Control Potato Flea Beetles and Leafhoppers

Potato insects in the Western counties were much more numerous than in the Eastern part of the state. Here, the large populations of potato flea beetles and leafhoppers presented a serious control problem to potato growers. The Colorado potato beetle, in comparison, was a minor pest. The major pests, however, can become a

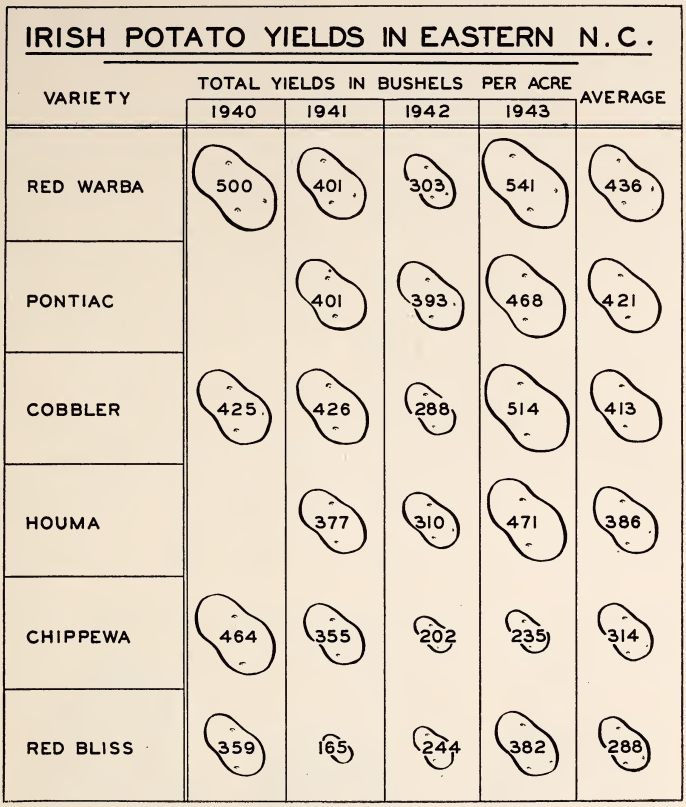


FIG. 40.

real threat to the successful production of seed potatoes in this region.

Control experiments were conducted at Jefferson, Ashe County, on a farm producing table and seed stock potatoes. The general control practice in this area is to use dusts, primarily because of the difficulty in using heavy spray equipment in the rolling terrain.

Plots treated with a dust of one part calcium arsenate mixed with three parts of Bordow showed an increase in yield of 45.0 per cent over check plots. The check plots were areas treated by the grower in his regular control program.

In this program, a dust mixture of 20 pounds of calcium arsenate, 20 pounds of copper sulfate and 60 pounds lime was used for the first half of the growing season. During

the latter half of the season a tricalcium arsenate, zinc arsenite and metallic copper dust (proprietary name, Copar) was used in the checks. The Bordow used in the test plots is a metallic copper dust, 12.5 per cent mixed with inert ingredients, 87.5 per cent.

Plots treated with a dust of one part cryolite to three parts Bordow showed a 31 per cent increase in yield over the check plots.

Soft Rot Follows Solar Heat Injury Of Early Potatoes

During the past two years, it has been found that bacterial soft rot develops in early Irish potatoes that have been exposed to direct sunlight during harvest. The extent of injury and subsequent soft rot depend on the length of exposure to sunlight. Potatoes exposed for six hours on a clear day in July, 1942, rotted in excess of 50 per cent after 6 days' storage (Fig. 41).

On a clear day in July, 1943, potatoes picked up immediately after digging had a temperature of 82.2° F., and developed 3.5 per cent soft rot after 14 days' storage. Similar potatoes picked up after an exposure of about 5 hours had a temperature of 116.6° F. and rotted to the extent of 78.5 per cent after 14 days' storage. In this test it was found that potatoes were injured after an exposure of one hour to direct sunlight.

Laboratory tests have shown that at room temperature the soft rot bacteria grow very rapidly on potato tubers subjected to radiant heat. The growth of bacteria smeared over the cut surface of heated potatoes indicates the extent of injury.

These studies have also shown that the tuber injury or physiological change is not always discernible to the eye. Potatoes held for 60 minutes in a water bath up to 116.6° F. did not show visible injury, but did support rapid growth of soft rot bacteria.

On the basis of these data it appears that potatoes exposed to direct sun-

FIG. 41. POTATOES SHOWING HEAT INJURY FOLLOWED BY SOFT ROT AFTER SIX DAYS STORAGE. THE POTATOES WERE EXPOSED FOR 6 HOURS TO DIRECT SUNLIGHT. (1. COBBLER, 2. KATAHDIN, 3. BLISS.)

light may be scalded or that some physiological change occurs within the tuber, making it more susceptible to soft rot bacteria.

In the harvesting operations, heat injury may occur at any step in the process if direct sunlight is permitted to strike the potatoes for prolonged periods of time. Potatoes on the ground in commercial fields have been found with temperatures as high as 126° F., and those exposed in burlap bags on loaded trucks as high as 123° F. It is very probable that some of the transit soft rot in the past has developed in potatoes injured by solar heat during harvest.

Dry Beans for the Nation's Bread Basket

Tests were begun in four geographical sections of the state in 1943 on the possibilities of dry bean production and for data on varietal performance. Replicated plots were established at Willard, McCullers, Statesville and Jefferson, but all plantings failed to give measurable results except those at Jefferson. The failures were due to extreme weather conditions, late planting in some cases and, perhaps, lack of adaptability to the section in which they were grown.

Eighteen varieties were included in the tests and the per acre yields varied from 11 to 36 bushels. The seven high yielding varieties are given in bushels per acre: Great Northern No. 59—36; Great Northern No. 15—33; Great Northern No. 13—31; Small White—31; Great Northern—30; Pinto—29; Great Northern No. 81—29 bushels per acre.

New Collard Introduced

On the basis of its uniformity, compactness, hardiness, and semi-heading qualities, a superior collard is being introduced to the trade. The plant from which the variety was developed was selected from a field near Wilmington in the spring of 1935. It has been re-selected each succeeding year and is now introduced under the name of Herring.

In 1943 trials, the Herring variety showed a high degree of uniformity in habit of growth and leaf characters in comparison with other commonly grown types. In contrast with most collards, the plant is low growing and very compact with a tendency toward heading (Fig. 42).

The leaf blade develops along the entire length of the leaf stalk and makes a very attractive plant. Foliage is heavy, dark green, and entirely free of any purple or red tinge, while the leaves are closely arranged on the stalk and form a heavy rosette center. The center leaves tend to form a small head that is crisp and tender. Quality of the collard when cooked is excellent.

The plants are relatively hardy, having gone through a very severe drought in the fall of 1943 and a week of freezing weather in December during which the temperature dropped to a minimum of 12° F. These plants have been grown in different soil types and have succeeded even under poor conditions.

Tomato Seedlings Show Resistance To Bacterial Wilt

As has been previously reported, Granville wilt (B. solanacearum) is rapidly becoming a serious disease of the tomato in North Carolina home gardens. And the commercial varieties developed for resistance to Fusarium wilt are not resistant to this disease.

In field tests during the summer and fall of 1943, lines were selected that showed definite resistance (Fig. 43). These resulted from crosses between Louisiana Pink and T414 (Lycopersicum esculentum from Porto Rico—P.I. No. 3814), and T414

FIG. 42. A TOP AND CROSS SECTION VIEW SHOWING THE COMPACTNESS AND HEADING CHARACTERISTIC OF THE HERRING COLLARD. (THE CROSS SECTION IS FROM THE SAME PLANT SHOWN IN THE TOP VIEW.)

crossed with Devon Surprise. The selections from the Louisiana Pink X T414 cross were by far the most resistant.

Both cuttings and seed of some of the most outstanding lines have been saved for further trial in the infected fields. Crosses between these selections and commercial varieties are being made in an effort to develop a desirable resistant variety for commercial and home garden use.

Nicotine, Pyrethrum and Cryolite In Pickleworm Control

Several dusts containing nicotine proved as good or better than undiluted cryolite for pickleworm control on summer squash, also some of them controlled aphids at the same time.

Pyrethrum dusts, however, failed to control pickleworms and the potato aphis *(Macrosiphum solanifolii* [Ashmead]) on the growing tips. These dusts were used in an attempt to find an insecticide to eliminate poisonous residue on the product.

Five dusts containing nicotine in physical or chemical combinations at 4 per cent strength were supplied by the Eastern Regional Research Laboratory. They were compared with ordinary nicotine dust at 4 per cent freshly prepared for each dusting from nicotine sulphate and hydrated lime, and with nicotine sulphate as a spray at one part to 800 with a wetting agent. Two impregnated pyrethrum dusts were used, diluted with pyrophyllite to .2 per cent pyrethrins.

The insecticides were applied five times from July 15 to August 13 and the results were taken from seven pickings of squash and from counts of infested growing tips of the vines. Three of the nicotine dusts gave control as good as cryolite. The nicotine-lime dust gave rather poor control and the nicotine spray was but little better than the untreated checks.

The percentage of wormy fruit for the seven pickings was 6 per cent for undiluted synthetic cryolite (83 per cent active ingredient) while the same material diluted with pyrophyllite to 50 and 33 per cent gave 11 and 10 per cent wormy fruit. There was no difference between the control obtained from natural and synthetic cryolite or between cryolite and barium fluosilicate. A dust of 33 per cent cryolite containing nicotine at 1 per

cent was no better than the same mixture without nicotine, although the nicotine was derived from the same product that gave good control at 4 per cent. Fruit from the untreated check vines was 67 per cent wormy.

All plots except one were dusted with a knapsack bellows duster with one or two puffs directed at each growing tip. For comparison of method of application, two rows were dusted with cryolite from a rotary fan duster throwing a continuous dust cloud along the row without regard to the location of the growing tips. Although the first method takes more time, the results were considerably better.

Pickleworms on Pumpkin and Winter Squash

During the summer of 1943, a number of varieties of winter squashes and pumpkins were grown to determine whether any showed resistance to the pickleworm. Pickleworms were found on some varieties of winter squash and pumpkins. In some cases, the fleshy stem was the only part attacked. The table queen or acorn squash (a variety of *C. pepo)* was considerably infested toward the end of the summer. None of the earlier fruits of either pumpkins or winter squash were affected.

When the first pickleworms appear there is considerable selection of host plants. The summer squash (which are also varieties of *C. pepo)* are attacked first. Several varieties including crookneck, scallop, cocozelle and zucchini, have been grown at Raleigh and appear to be equally susceptible. As the pickleworm population increases, resistance becomes mainly a matter of hardness of the rind for even the fruits of summer squash become partly immune if they remain on the vine a week.

FIG. 43. TYPICAL SCENE IN THE WILT PLOTS AT HESTER. ALL PLANTS IN THE PHOTOGRAPH HAVE WILTED EXCEPT THE ONE IN CENTER FOREGROUND.

FIG. 44. LETTUCE PLANTS FOLLOWING SODIUM NITRITE SOIL TREATMENT FOR DAMPING-OFF (LEFT) AND NO TREATMENT (RIGHT).

It is doubtful if any variety of pumpkin or winter squash is entirely immune, but these crops can be grown with very little loss if started early enough to mature most of the crop before August 1 in the middle of the state or earlier in the eastern part.

The fruits should be removed from the field as soon as they are mature and stored in a dry place where they will keep until the middle of the winter. Vine borers sometimes enter the rind of winter squashes and pumpkins left in the field in late summer, causing a wound that soon produces rot.

Sodium Nitrite Soil Treatments Show Promise Against Vegetable Crop Diseases

Laboratory, greenhouse, and field experiments in 1942 and 1943 indicated that soil treatments with sodium nitrite may prove effective in combating Rhizoctonia damping-off of lettuce and root knot of certain vegetable crops.

Under greenhouse conditions, sodium nitrite was the only one of a number of nitrogenous compounds tested that effectively reduced post-emergence damping-off of lettuce in potted soils artificially contaminated with Rhizoctonia. In laboratory studies it was found to be highly toxic to pure cultures of Rhizoctonia growing in soil in test tubes at concentrations as low as 1250 parts per million and was partially toxic at 670 parts per million. Lettuce plant bed soils were artificially contaminated with Rhizoctonia and treated at the rates of 4 and 8 ounces per square yard four weeks prior to seeding. Post emergence damping-off was reduced by 71 and 95 per cent at the respective rates. At the higher rate, stands were reduced to some extent but control, at both rates, was superior to that afforded by treatments with chloropicrin, formaldehyde, or urea (Fig. 44).

Under field conditions, sodium nitrite at 4 and 8 ounces per square yard, applied to soils naturally infested with the root-knot nematode seven weeks before planting, substantially reduced root-knot infection of bean, okra, squash, and tomato. Root-knot index readings ranged only up to 3.2 for the lower, and 1.0 for the higher rate as compared to 56 to 71 where no treatment was applied. The

FIG. 45. SQUASH ROOTS FOLLOWING SODIUM NITRITE SOIL TREATMENT FOR ROOT KNOT (LEFT) AND NO TREATMENT (RIGHT).

treatments reduced stands only in the case of beans, and, at the higher rate, control was as good or better than that afforded by chloropicrin or urea (Fig. 45). On squash, the heavier rate resulted in increased vigor and yields, due primarily, it is believed, to an increased amount of available nitrogen.

While this material shows promise, its use for treating soil is new and considerably more information is needed to determine its effects on the physical and chemical properties of the soil, its toxicity to crop plants, and the most effective rates and time of application.

Nitrogen Requirement for Lettuce

Failure of Iceberg lettuce to head properly has been associated with an excess of nitrogen in the fertilizer. This may be serious only in the late crops that head in warm weather.

An experimental study of the problem at the Soils Research Laboratory has shown that in dry seasons, the soluble nitrate in the soil is brought to the surface where the moisture supply is too low for the roots to grow. If dry weather persists, the lettuce will form sound heads. Rain, falling during the period of heading, will carry the nitrogen downward to the roots causing the lettuce leaves to straighten out and form a soft and unmarketable head. This effect has given rise to the common opinion that warm rains cause the soft heads. If the supply of available nitrogen in the soil is not greater than the need of the crop, the heads will remain firm, even when rain follows a dry period, unless they are attacked by disease.

Losses of nitrogen from lettuce soils have been greatly exaggerated. Chemical analyses of samples taken from nineteen fields at the end of a month in which the rainfall was double the average for that month, gave unmistakable proof that there was no critical shortage of nitrate nitrogen. On many fields, however, the lettuce plants had turned yellow and failed to grow normally.

This condition, which was definitely most serious in plants that came from early sown beds, is evidently associated with an unidentified effect of

waterlogging. If the damage is done early enough in the season, many of the plants may recover. Growers who mistake this for a symptom of a nitrogen deficiency and sidedress with a soluble nitrogenous fertilizer, run the risk of supplying too much of this element and getting soft, oversize heads (Fig. 46).

Lettuce Seed Treatment Proves Beneficial

Results of a large number of lettuce seed treatment tests under greenhouse and plant bed conditions show that this practice will pay substantial dividends to North Carolina growers in better stands and decreased seed costs. Rates of seeding used in the commercial head lettuce area are often two to three times as great as would be necessary if seed treatment were practiced.

Ten experimental plantings, each including four varieties of head lettuce and romaine treated with a number of different materials were completed in 1943. Without exception, significant stand increases resulted from treatment with one or more of the materials used (Fig. 47).

Yellow cuprocide and Spergon gave the best results and stand increases ranging from 10 to more than 100 per cent were recorded. Several lettuce growers who treated seed for the fall planting in 1943 reported highly satisfactory results.

Vegetable Brining Aids In Emergency Food Conservation[1]

The preservation of many vegetables by brining or salting has helped greatly in meeting the recent emergency in the food situation.

Experiments conducted over a two-year period at Raleigh served as a basis for the preparation of Farmers Bulletin 1932 recommending this method for both the domestic and commercial preservation of vegetables.

How much this method has been used cannot be given in actual figures. However, more than 360,000 copies of this bulletin were distributed during the summer of 1943 either as the result of direct requests or through agencies promoting the brining and

[1] Cooperation: Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture.

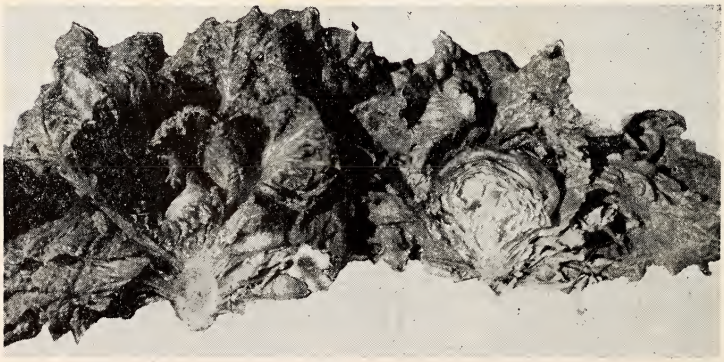


FIG. 46. CROSS SECTION OF HEAD. LEFT: 1000 LBS. 10-7-5 FERTILIZER AN ACRE; RIGHT: 1000 LBS. 5-7-5 FERTILIZER AN ACRE.

FIG. 47. STAND OF BIG BOSTON LETTUCE FOLLOWING SEED TREATMENT WITH SPERGON (LEFT) AND NO TREATMENT (RIGHT).

salting of vegetables. Salt companies report a large increase in sales of salt bagged for domestic use during the past summer and lay this increase to the domestic preservation of vegetables by means of salt.

Estimates of the quantity of vegetables brined or salted by commercial companies in 1943 exceed 50 million pounds. Vegetables preserved by this method are used by manufacturers of soups and mixed and strained vegetable products. In certain instances, the entire output of these companies depends upon the use of salted vegetables. An acute emergency faced the manufacturer of these products because of the restricted use of metal for the preliminary bulk preservation of vegetables and because of the scarcity of frozen vegetables. The preservation of vegetables by salting was introduced by agencies responsible for conserving food in countries occupied by the Allies. The Foreign Economic Administration has reported excellent progress with this means of preservation.

The post-war possibilities in the commercial salting of vegetables for use by the manufacturers of certain food products is most promising. Advantages of this method include: a large saving of space and weight; a reduction in cost due to elimination of temporary bulk preservation in sealed, metal containers that require heat processing; and in certain cases, a reduction in nutrient losses of the preserved vegetables.

Fermate Offers Promise In Control of Frogeye Leafspot of Apple

Weather conditions were quite favorable for the appearance of apple diseases in 1943 in Wilkes County. Black rot (frogeye) on the foliage and bitter-rot of the fruit attained epidemic proportions. Blotch and scab of the fruit and foliage were moderate to severe. As in the past, reduced concentration of Bordeaux mixture (1-3-50)[1] was not as effective as the stronger concentration (4-4-50) in the control of bitter rot. Reduction in spray injury (russet) was not as noticeable with the weaker Bordeaux concentration as in previous years. Basic-copper sulfate, copper oxychloride, Cupro-K, Fermate (ferric-dimethyldithio carbamate), and chemically reduced silver were tested as substitutes for Bordeaux mixture. With the exception of Fermate, the substitutes did not equal Bordeaux in disease control.

Fermate surpassed all the other fungicides used in the control of frogeye leafspot. It was used at a 3-5-100 concentration. Leafspot counts were recorded at the middle of the season, and at harvest. The Fermate plots exhibited a 10.7 per cent leaf infection at the end of the season with no defoliation.

The remainder of the sprayed plots ranged from 41.4 per cent infection for 4-4-50 Bordeaux mixture, to 66.1 per cent for 3-3-50 Tennessee copper "26" with some defoliation. The untreated plots exhibited 100 per cent infection at both counts with half defoliation at the end of the season.

New Type Storage for Apples Proving Successful

At the Apple Research Laboratory in the Brushy Mountains the controlled-atmosphere storage experiment started in 1940 has proved that such tender apple varieties as Stayman Winesap can be kept from picking time until the following May, June, or July in excellent condition.

To be successful with this type of storage, growers should follow these steps:

1. Pick apples when fully tree-ripened and well colored.
2. Place apples in storage room immediately after picking and grading.
3. Extra large apples and those with defects, such as worm holes, broken skins or serious bruises, should be sorted and sold during the fall as they will not keep until late spring or summer.
4. Keep each variety in a separate room as one variety often causes another to ripen prematurely.
5. Seal storage room as soon as it is filled with fruit, and maintain constant air circulation.
6. Maintain a temperature of 40° F.
7. Sample air at intervals from the storage room to determine the percentage ratio of carbon dioxide and oxygen.
8. After carbon dioxide has increased from 0.5 to 10.0 per cent, maintain this percentage by admitting fresh air, or by drawing part of the air in the storage room through an air washer in which a lye solution absorbs part of the carbon dioxide.

Apples kept in a controlled-atmosphere storage will retain their flavor, crispness, and juiciness for several weeks after they are taken out of storage the following spring or summer. It is possible to keep apples the year around under such conditions.

[1] The second figure given in all formulas represents the amount of lime, in pounds used to neutralize the Arsenate of lead, included in all sprays, and the copper, when used.

An experiment is under way to find out what combination of varieties, if any, can be stored in the same room without one seriously affecting the keeping qualities of the other. Stayman Winesap and Red Winesap are stored in the same room during the 1943-44 season.

Apple Leafhopper Control

Cultural and chemical experiments for the control of apple leafhoppers were conducted at West End, Moore County.

The cultural methods were tried in plots of 80 trees to the block and consisted of the following treatments: (1) Burning the vegetation around the trees and in the rows one month after the ground had been disced twice in the preceding three months (referred to as the "burned" area); (2) Burning the vegetation three weeks after the ground had been disced three times in the preceding three months (referred to as the "cultivated and burned" area); (3) Discing the ground three times during the last three months of 1942 (the "cultivated" area).

Population samples were taken to determine the relative abundance of leafhoppers at various times of the year. The apple leafhopper *(Erythroneura lawsoniana)* was first collected in 1943 on May 25 in the vegetation of the "burned" and the "cultivated" plots. Thereafter, it was usually collected in the foliage of the apple trees and seldom taken in the vegetation. These leafhoppers were not very abundant until August, when some damage to apple leaves became apparent. The mottling of the leaves, characteristic of leafhopper feeding, increased during August and the record of population counts shows a peak of abundance in mid-October, about one month after the apple harvest. No extensive damage by leafhoppers to the fruit was noticed.

The chemically treated plot differed from the regularly treated (or check) plot in that it had one application of a soap-nicotine sulphate—½ per cent summer oil spray instead of the regular first cover spray of lead arsenate-lime sulphur. This treatment was applied within two weeks of the last regular spray application of lead arsenate-lime sulphur.

Slight injury to the foliage resulted from the use of the summer oil spray that should not have been applied until two weeks or more after the last application of a spray containing sulphur. There was no significant difference between the summer oil treated plot and the check plot in the number of apple leafhoppers.

Controlling Root Knot of Peaches

Experiments in the sandhills during 1943 were designed primarily to check on the length of chemical soil treatments on root-knot control where the chemicals were applied in 1941 and 1942, and the value of Shalil rootstock in root-knot control.

The results from these studies indicate that urea, applied at the rate of 1 pound per square yard, retarded the severity of root knot for a period of two years, but was not effective the third year. The following root-knot indices were exhibited on peach trees planted in 1941, 1942, and 1943 on land where the urea treatment was applied in the fall of 1940: 2.4, 3.6, and 40.0, respectively. Applications of ½ pound of urea per square yard, applied in February, 1942, showed a response similar to the 1-pound rate in that the root-knot index in 1942 was 0, and in 1943 was 4.7. Tree injury was quite apparent the first season following application of the chemical. However, injury was not noted in the second and third years. Late application of the chemical is believed responsible for the injury during the

first season. Sodium nitrate was ineffective after the first year.

Results with cyanamide (1 pound per square yard), were, in general, similar to those obtained with urea, although the degree of control was not as good as with urea. Chloropicrin (35 c.c. per square yard) gave excellent control the first year, fair the second, and no control the third year after application. Root knot indices for chloropicrin for the three years were 0, 25, and 77.1, respectively. Trees on untreated land exhibited indices of 58, 50, and 83, respectively, for the three-year period.

Shalil rootstock continued to exhibit practical immunity to the root-knot nematode in tests in the sandhill area. It appears as though this or some other resistant rootstock offers the most practical means of controlling root knot on peaches.

Peach Tree Borers Reduced

Research work since 1939 has shown that by using ethylene dichloride emulsion, it is possible to kill such a high percentage of peach tree borers that the population is also reduced the following year.

Prior to 1940, paradichlorobenzene was the material most commonly used in controlling the peach tree borer. When used properly and at the right time, paradichlorobenzene will give fair control. However, many of the growers had an average survival of one or two borers per tree after using paradichlorobenzene, and this resulted in an average infestation of 10 to 12 borers per tree the following year. In 1940, 225 acres of 7 year old Elbertas which had an average infestation of 11 borers per tree, were treated with an emulsion of 25 per cent ethylene dichloride. After this treatment, there was an average survival of only one borer in every three trees. This survival gave rise to an average infestation of two to three borers per tree the following year. This orchard was treated with a 25 per cent ethylene dichloride emulsion in 1940 and 1941. In 1942 and 1943 the ethylene dichloride was reduced to 15 per cent. In the spring of 1944 the treated trees had an average survival of one borer in every eight trees; the untreated trees had an average of one borer per tree. Thus in 4 years the peach tree borer population before treatment was reduced from an average infestation of 11 borers per tree to an average of one borer per tree. The infestation after treatment was reduced from an average of one borer per tree to an average of only one borer in every eight trees.

White Peach Scale Controlled

Satisfactory results were obtained again in 1942-43 by giving trees infested with white peach scale two thorough applications of a 3 per cent dormant oil spray about two weeks apart. So far no injury has been reported from these applications.

Sprays applied in the fall as soon as the trees had shed all their leaves gave better results than those applied later in the winter.

Liquid lime-sulphur, different types of oils, different concentrations of oils, oil in combination with sulphur, rotenone, calcium cascinate, walnut shell flour, "Elgetol," and "microgel" (Copper fungicide) were tried at different times during the dormant season but without satisfactory results. The addition of rotenone, calcium cascinate, walnut shell flour and "microgel" seemed to decrease the efficiency of the oil spray. The addition of sulphur or "Elgetol" seemed to have little or no effect.

Young Peach Trees Need Phosphorus

Peach trees set on newly cleared land will make better progress if given a complete fertilizer. The practice of using only soluble nitrogen as

a fertilizer during the first years of an orchard may result in certain mineral deficiencies.

Young peach trees at the Peach Research Laboratory at Eagle Springs have shown marked symptoms of phosphate deficiency after three years of a "no phosphorus" fertilizer program. These trees have made less top growth, had smaller trunks and have been less healthy in appearance than nearby trees fertilized with moderate amounts of phosphate. The trees receiving phosphate have averaged almost twice as much top growth and 50 per cent greater increase in trunk circumference.

In addition to being smaller, the phosphate deficient trees had inferior foliage. Toward the end of the season the leaves became purplish brown, had a leathery texture and shed from the trees easily.

The effects of insufficient potash, magnesium and calcium are also under study at the Peach Research Laboratory. Analysis of the leaves have shown that the omission of any of these elements changes the mineral nutrient balance of the leaves. However, visible signs of deficiency have not yet developed and growth of these trees has been equal to those receiving complete fertilizer.

SMALL FRUITS

Massey Produces More and Larger Strawberries[1]

In a series of variety and cultural tests at the Coastal Plain Experiment Station in 1943, Massey produced greater yields and larger berries on both spaced and matted beds than did any of the four other varieties tested.

Spaced beds of Massey yielded at the rate of 208 crates per acre compared with 145 crates for Blakemore, 141 for Missionary, and 137 for Klonmore. There was no difference in yield from spaced and matted beds on Blakemore and Missionary, but Klonmore produced 137 crates per acre on spaced beds compared with only 81 for matted, and Massey produced 208 on spaced beds compared with 184 on matted. Massey also produced much larger berries than any other variety. Spaced beds of Massey averaged 62 berries per pound compared with 84 for Blakemore, 86 for Klonmore, and 97 for Missionary. The spaced beds produced the largest berries on all varieties.

Using the average yields for each variety from spaced and matted beds and the official price quotations from the Wallace market, Massey was worth $1,370 per acre, Blakemore $1,030, Missionary $931, and Klonmore $782.

Blakemore and Massey Strawberries Bring Greater Returns[1]

The combination of Blakemore and Massey strawberry varieties brought 50.6¢ per crate more than Missionary on the Wallace market during 1943, returning to the growers of that region $23,096.88 for the season. Both varieties were developed through the cooperative breeding program, and seem to offer a highly satisfactory combination of early and midseason varieties.

Because of its large size, fine flavor, and good yielding ability, the Massey has rapidly won favor as a companion berry to Blakemore in this region.

During the 1943 season, Massey made up 39 per cent, Blakemore 27 per cent, and Missionary 34 per cent of the crates sold on the Wallace market. In a season with less frost

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

damage the percentage of Blakemore would probably be proportionately greater.

Degree of Calcium Saturation Affects Growth of Young Strawberry Plants[1]

The beneficial effect of lime on strawberry production in Eastern North Carolina has been known for several years. But more information was needed on the amount required for the best growth on different types of soils. Therefore, a virgin soil (Coxville fine sandy loam) with a pH of 3.93, high in organic matter was treated with limestone in increments of 12.5, 25, 50, and 100 per cent of the amount required to neutralize the soil acidity (otherwise referred to as percentage of calcium saturation). Strawberry plants were set in this soil in August. It was very difficult to get plants to live in the low lime treatments.

Typical growth of the plants in the

[1] Cooperation, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 48. NO LIMESTONE APPLIED.

FIG. 49. 12.5 PER CENT CALCIUM SATURATION.

FIG. 50. 50 PER CENT CALCIUM SATURATION.

FIG. 51. 100 PER CENT CALCIUM SATURATION.

fall is shown in Figures 48, 49, 50 and 51. Maximum growth was obtained when the soil was between 25 and 50 per cent saturated with calcium and was retarded as the saturation reached the 100 per cent level.

These data indicate that there is a definite relationship between the degree of calcium saturation of the soil complex and the growth of strawberry plants. When these requirements are met, the farmer may expect more of the plants to live in the summer, more growth in the fall, and greater production in the spring.

Fertilizer Needs of Strawberries On New Land

An experiment to find the fertilizer requirements of strawberries on new land has just been completed. The land use for this experiment was the Coxville fine sandy loam type, level but well-drained with ditches. From the data of this experiment and other experiments extending over a period of years, the following salient requirements for strawberries on new land appear:

1. Limestone to raise the pH to 5.0 to 6.0.
2. Liberal supply of phosphate fertilizer (Fig. 52).
3. Nitrogen—60-100 pounds per year, the source depending on the most economical material available, but preferably some from an ammonia source unless very frequent applications are to be made.
4. Potash—40-80 pounds per year.

Large Fruited Dewberry Seedling Developed[1]

Dewberries large enough to be eaten out of the hand like an apple may sometime be the rule instead of the exception. Already fruits of one selection average three to four times the size of those of the principle commercial variety, Lucretia (Fig. 53). Moreover, the fruit of this selection is of good dessert quality and the plant is vigorous and productive. Other large fruited seedlings have been developed in the breeding program but none has had the other qualities necessary in a commercial fruit.

For many years, the dewberry was an important cash crop in sections of Eastern North Carolina. In recent years disease has reduced acre yields and shipping quality and at the same time, competition on the market with other fresh fruit has increased. Several very promising selections are now under test to determine their performance under field conditions and to develop a sufficient stock of plants to make possible their introduction.

[1] Cooperation, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture.

FIG. 52. THE EFFECT OF PHOSPHATE ON STRAWBERRY PLANT GROWTH ON NEWLY CLEARED LAND. IN FRONT OF STAKES: 3-0-6 FERTILIZER (NO PHOSPHATE): IN BACK OF STAKES: 3-8-6 FERTILIZER (COMPLETE FERTILIZER).

FIG. 53. LARGE FRUITED DEWBERRY SELECTION COMPARED WITH THE PRINCIPAL COMMERCIAL VARIETY, LUCRETIA. (ACTUAL SIZE.)

FLOWERS AND NURSERY

Sawdust Good Mulch for Azaleas

A comparison of various mulching materials for azaleas has shown that ordinary pine or cypress sawdust, when properly handled, is much better than oak leaves or pine straw.

The materials usually recommended for mulching azaleas are granulated or imported peat, oak leaves and pine straw. Peat makes an excellent mulching material and azaleas mulched with it make the best growth, however, at the present time it is not always available.

The plants mulched with sawdust in the test plots at State College made an excellent growth forming the best root systems of any of the mulch treatments.

A representative plant, when lifted from the pine sawdust plot (Fig. 55), retained a clump of earth which, with

FIG. 54. TYPICAL PLANT FROM THE CYPRESS SAWDUST MULCH PLOT.

FIG. 55. TYPICAL PLANT FROM THE PINE SAWDUST MULCH PLOT.

the plant, weighed 33 pounds, while one from the cypress sawdust plot (Fig. 54) weighed 23 pounds. The average plants from the oak leaves (Fig. 56) and pine straw plots (Fig. 57) weighed only 3 and 8 pounds respectively.

Herb Trials

Most of the herbs and essential oil plants of possible economic importance have been grown at the branch stations.

It has been found that production is easy but that harvesting, storing and processing are too costly to encourage commercial production within the present market prices. There are possibilities of a good cash income from sage, coriander, sesame, fennel and mints if the enterprise is handled capably. For individual herb gardens, most of them thrive in all sections of the state.

FIG. 56. TYPICAL PLANT FROM THE OAK LEAF MULCH PLOT.

FIG. 57. TYPICAL PLANT FROM THE PINE STRAW MULCH PLOT.

Observations on Rubber Bearing Plants

As part of the war emergency effort, plantings of two species of rubber-bearing plants were made in representative parts of the state.

The Russian dandelion *(Taraxacum koksagyz)* was rather extensively tested. Although heavy seedings were made and a fair to good emergence secured, only a few plants grew to satisfactory size. All died during the dry summer weather. A few hundred plants, grown in the greenhouse and planted to the field in early spring, made fair growth but root production was weak. No commercial plants were produced.

From the observations made, it would appear that this natural rubber source would not be a satisfactory crop in North Carolina. Subsequent reports from tests elsewhere bear out these observations and it is unlikely that the species will contribute much to the rubber production program in America.

Test plantings of guayule *(Parthenium argentatum)* a native plant of the Southwestern United States and Mexico were made at Raleigh and Willard. This species is in limited production and use in the Southwestern United States.

A few plants survived the winter of 1942-43 at Willard and at Raleigh but died during the summer. All plants were heavily infected with southern root-knot *(Sclerotium rolfsii)*. Evidently, the climate and acid soils of the North Carolina Coastal Plains do not fill the growth requirements of guayule.

Understocks Important To Fruit Grower

The development of superior rootstocks is vital to fruit growers and nurserymen. Qualities needed in rootstocks are disease and insect resistance, hardiness, soil tolerance, reliable consistency and definite growth characteristics.

Since native plants, through centuries of adaptation, offer a source of understocks with these qualities, tests are underway to determine the advisability of using closely related wild plants as understocks for commercial, imported or improved species.

Of first importance are the rosaceous species: apples, plums, cherries, haws and roses. Better understocks are being collected for such ornamentals as fringe tree, hollies, firethorns, camellias, azaleas and conifers. Wild understocks from other countries are also being tested for comparison.

FIG. 58. STEERS WEIGHING 1000 POUNDS AND READY FOR MARKET, BUT THEY HAVE CONSUMED LESS THAN A TON EACH OF FEEDS SUITABLE FOR HUMAN CONSUMPTION.

LIVESTOCK and POULTRY

BEEF CATTLE

Wintering Weaned Calves On Reed Pasture Is Profitable[1]

Tests conducted at Blackland Station from November 12, 1942, to May 14, 1943, with four groups of weaned Grade Hereford calves show the value of reeds for wintering. Comparisons were made between wintering on reeds, plus two or four pounds of cottonseed meal per calf daily, and wintering on farm feeds plus rye or rye grass pasture.

No feed was given the two groups on the farm while grazing on rye or rye grass pasture, but when grazing was not available these calves were fed two pounds of cottonseed meal per head daily, plus farm roughage. The calves in the reeds were alternated between the two pastures at each 28-day weigh period.

The average gains for the calves on the reeds were 81 pounds for the group receiving two pounds of cottonseed meal per head daily and 120 pounds for the group receiving four pounds. The calves were turned on the rye pasture on January 2 and to May 6 had obtained 67 days grazing. The rye grass was grazed from January 15 to March 5, then from March 19 to May 14, a period of 105 days. For the entire wintering period the rye group had made an average gain of 123 pounds and the rye grass group 144 pounds, but the cost of wintering was much greater than for the groups supplemented on reeds. All four groups remained thrifty and were wintered in a satisfactory condition. They were grazed together on reeds the following summer to study the effect of wintering on pasture gains. At the close of the pasture season the average weights were 618, 633, 636 and 637 pounds for the groups wintered on two and four pounds of cottonseed meal, and rye and rye grass, respectively.

The group that received four pounds

[1] Cooperation: Bureau Animal Industry, U. S. Department of Agriculture.

of cottonseed meal per head daily during the winter averaged 39 pounds heavier per animal at the close of the wintering period than the group that had receievd two pounds. However, the gains of this group during the following grazing period were enough greater so that by the close of the grazing season that fall there was only a difference of 15 pounds per animal.

In a similar way, the average difference of 20 pounds per animal between the rye and rye grass groups at the close of the wintering period had been reduced by the greater summer gains of the rye group.

In neither case was the greater final weights of the farm-wintered groups nor the group that received four pounds of supplement (all three of which were practically equal) sufficient to offset the cheaper wintering of the group that had received only two pounds of supplement during the winter (Fig. 58).

Wintering Weaned Calves On Cottonseed Hulls and Protein Concentrate[1]

Twenty-nine grade Hereford weaned calves were wintered at the Hofmann Forest from November 20, 1942, to May 3, 1943, on two pounds of cottonseed meal or soybean oil meal and approximately ten pounds of cottonseed hulls per head daily, plus access to forest range. During this 164-day period the calves made an average daily gain of .97 pound and remained remarkably thrifty throughout the winter.

The forage used in the forest range consisted chiefly of browse from hardwood shrubs, young hardwood trees and green briar leaves. Apparently, this forage corrected the vitamin A deficiency expected from a ration composed of cottonseed hulls and cottonseed meal or soybean oil meal.

Beef Cattle May Be Wintered Economically On Forest Range[1]

Two tests conducted at the Hofmann Forest bring out the relative value of different amounts of protein concentrates for wintering beef breeding cows on forest range. The cows were rotated between the different pastures at each 28-day weigh period. Forage used in these pastures consisted chiefly of reeds, browse from hardwood shrubs and green briars. The calving season extended from about the first of February to the first of May, and was rather evenly distributed among the groups.

In the first trial, cows were fed two and four pounds of cottonseed pellets or meal per head daily from February 13 to May 8, 1942.

In the second trial, cows were fed soybean oil meal at the rate of two, four and six pounds per head daily from December 18, 1942, until May 4, 1943.

For the average wintering period of 110 days the cows receiving 220 pounds of protein concentrate made a yearly gain of 18 pounds, those receiving 440 pounds a gain of 25 pounds, and those receiving 660 pounds a gain of 68 pounds. The respective average total gains of the calves were 218, 238, and 271 pounds.

Apparently for the first year at least, the plane of nutrition for wintering had not materially affected the subsequent breeding season because the percentage of cows that calved in 1943 was just as great from the two- as from the four-pound group.

These studies brought out the practicability of wintering beef breeding cows on forest range. All groups came through the winter satisfactorily and even the group receiving six pounds of protein supplement per

[1] Cooperation: Bureau Animal Industry, U. S. Department of Agriculture.

head daily was wintered much more economically than it could have been wintered on the farm. Furthermore, grazing observations revealed no evidence of pines (which are the type of reforestation desired in that area) being browsed. Most of the difference in gains of the groups of cows during the winter was offset the following summer by the greater gains of the cows that had received the least supplement the preceding winter.

DAIRY CATTLE

Station's Bull Has Outstanding Breeding Record

Carolina's Brae Champion, an approved Ayrshire sire, son of Penhurst William Tell, and Bellefonte's Brae Daisy, was bred and raised on the North Carolina Experiment Station farm at Raleigh (Fig. 59).

He is the sire of 49 registered daughters and 21 registered sons. He has sixteen daughters averaging 9,718 pounds of milk and 400 pounds of fat. His equal parent index is 10,989 pounds of milk, 4.07 per cent fat, and 447 pounds of fat.

Butter In State Has High Vitamin A Value

The carotene and vitamin A content of butters from seven creameries in the Piedmont Section and three creameries in the Mountain Section are being investigated at bimonthly intervals during the year. In addition, moisture, salt, curd, fat, and score values are taken. The butter samples from these 10 creameries are representative of 90 per cent of all creamery butter made in the State.

Thus far, North Carolina butters have compared very favorably in total vitamin A value with butters from other states in the nation. Because of the long grazing season in the state, the vitamin A values reach a high point earlier in the spring and remain so later in the autumn than do those in Northern states. Butters collected

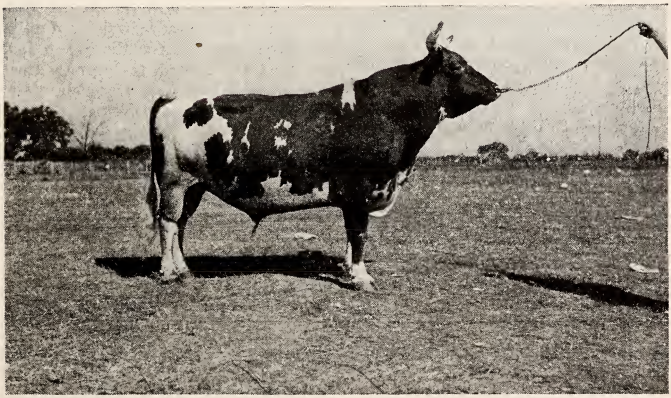


FIG. 59. CAROLINA'S BRAE CHAMPION HAS OUTSTANDING RECORD.

during July and August had an average carotene value of 5.88 micrograms per gram and an average vitamin A value of 6.55 micrograms per gram.

Other butter characteristics varied greatly. Thus the percentage of extremes for butters from the 10 creameries mentioned above were as follows: moisture, 11.5 to 16.7; salt, 0.25 to 4.0; curd; 0.40 to 1.54; fat, 77.9 to 85.8; score, 87.0 to 90.0.

Save the Good Dairy Calves—Feed Limited Rations

Heifer calves of good breeding should be saved and grown out on limited rations, even though there is a tendency to veal or destroy calves because of high feed and labor costs.

As was shown in a recent experiment when good pastures are available, heifers may be wintered on limited rations. Two groups of heifers were fed all the corn silage they would eat. In addition, each animal in one group received two pounds of cottonseed meal and each animal in the other group received one pound of cottonseed meal and five pounds of sample grade lespedeza hay. Growth was satisfactory in both groups with very little difference in weight, height at withers and circumference of chest.

Mastitis—Still A Management Problem

The management of the dairy herd from the standpoint of sanitation is the problem that deserves the greatest emphasis in the control of mastitis. The proper management of the negative and successfully treated animals greatly reduces their chances of infection and reinfection. Six hundred and eighty-three infected quarters of milk cows were treated with either sulfanilamide and mineral oil or colloidal silver oxide for the control of mastitis. The results prove that chemo-therapy has a place in mastitis control, but under field conditions the results do not appear as strong as are often expected.

The direct microscopic test alone has been found inadequate as a diagnostic procedure, especially in those herds where the invading organisms are other than Streptococcus agalactiae. The test for hemolysis on cow's blood agar used with a microscopic examination of the milk is aiding greatly in the diagnosis of the invading organisms.

Optimum Level of Roughage for Dairy Cows

During the winter of 1942-43, one group of Jersey cows was fed 0.8 pounds and another, 1.6 pounds alfalfa hay daily per 100 pounds of body weight. The first group received 0.54 pounds concentrates per pound of milk produced and the second, 0.54 pounds per pound of milk in excess of 10 pounds per day. All cows were fed silage at the same rate relative to their body weight.

The cost per hundredweight of milk produced was less for the group fed the most hay though their production was also slightly less. However, they did not receive as many total nutrients; it is likely that if they had been fed more concentrates, say, 0.54 pounds per pound of milk in excess of 8 pounds, there would have been little difference in production.

The hay and concentrates used cost $22 and $40 per ton, respectively. The corresponding costs of total digestible nutrients were $2.12 and $2.70 per 100 pounds. The results emphasize the importance of making the greatest use of feeds that furnish nutrients at a low cost as long as production is not seriously affected.

Dehydrated Sweet Potatoes As A Feed For Growing Pigs

Preliminary trials to learn the feeding value of dehydrated sweet potatoes indicate that more research will be necessary to establish definitely their place in swine rations. The results show that dehydrated sweet potatoes are palatable and readily consumed by pigs, but are evidently too bulky and too low in food value to cause them to gain normally. It is also apparent that a protein supplement cannot be self fed free choice with dehydrated sweet potatoes since in this trial the pigs consumed one pound of protein supplement for each 1.75 pounds of sweet potatoes. The addition of soybeans improved the ration but even under this method of feeding, the pigs required 434 pounds of sweet potatoes, 178 pounds of soybeans and 84 pounds of protein supplement for each 100 pounds gain.

Pigs fed a basal ration containing 72 pounds of ground yellow corn gained 30 per cent more than the highest gaining group fed sweet potatoes.

Plant Proteins As Supplements To Corn for Fattening Pigs

Because of the shortage of animal protein supplements, an experiment was undertaken at the Blackland Experiment Station, Wenona, to determine the value of a mixture of plant proteins with and without animal protein for fattening pigs.

It had been learned in previous trials that when plant proteins were self fed free choice the pigs ate a greater quantity than was necessary to balance the ration, therefore, in this experiment limestone and salt were added to the protein supplement.

Eighty pigs with average initial and final weights of 88 and 228 pounds, respectively, were divided into four equal groups and fed until they had attained the required weight. Each group was self fed, free choice, white shelled corn and a protein-mineral supplement. Tankage, cottonseed meal, soybean oil meal and peanut oil meal were used as protein sources.

The results from this one trial indicate that a mixture of plant proteins is a satisfactory supplement to white corn for fattening 88-pound pigs and that the addition of minerals to the protein supplement mixture reduces the amount consumed by pigs that are self fed, free choice.

The utilization of feed was not improved when 20 per cent animal protein was added to the plant protein-mineral mixture.

Ground Wheat Versus Yellow Corn for Fattening Hogs

Results from an experiment at the Mountain Experiment Station have shown that the feeding value of ground wheat compares well with that of yellow shelled corn. Three groups of ten pigs each, weighing an average of forty pounds, were provided. All three groups of pigs were fed from "self feeders," and each was given the same mineral and protein supplement. In addition, group No. 1 was fed shelled yellow corn, group No. 2 was offered the choice of ground wheat and shelled yellow corn, and group No. 3 was fed ground wheat.

Each group was fed to an average final weight of approximately 225 pounds or for an average gain per pig of 185 pounds. It required 112 days for group 1, 104 days for group 2, and 107 days for group 3 to reach this required gain.

The pigs that were fed wheat consumed only a little more than half as much protein supplement as those

on corn alone, but the total feed consumed and the rate of gain were practically the same when either corn or wheat was fed as the basic grain.

Soybeans and Soybean Products, With Supplements, for Growing Pigs

Previous work at this Station has shown that forty-pound pigs, when fed a ration containing 78½ per cent soybeans, have usually failed to gain normally even though the ration was supplemented with animal proteins, minerals and ground legume hay. Therefore, two experiments were undertaken during the past year (1943) to determine the nature of the nutritional deficiencies in the soybean ration and to find, if possible, practical supplements that might improve the gains of pigs fed largely on soybeans.

In the first experiment, twenty-four 40-pound pigs were fed for a 102-day period, in six different groups of four pigs each. The basal ration and the average daily gains per pig were as follows: Group 1, ground raw soybeans for 0.40; group 2, cooked soybeans for 0.94; group 3, soybean oil meal for 0.73; group 4, soybean oil meal plus 10 per cent crude soybean oil for 0.85; group 5, soybean oil meal plus 10 per cent corn starch for 0.73; and group 6, a standard corn-cottonseed meal fattening ration for 1.21 pounds.

In the second experiment, the addition of 0.3 per cent of either cystine or methionine to the raw soybean ration caused pigs to double their weight in 32 days after they had failed to gain for 81 days **without** these supplements. Thus, it is obvious that raw soybeans are deficient in essential amino acids and will not produce normal growth and gains on forty-pound pigs.

SHEEP

Control Internal Parasites In Sheep With Phenothiazine-Salt Mixture

In tests conducted in 1943 a mixture of one part by weight of powdered phenothiazine and twelve parts of loose salt controlled internal parasites of sheep at four different locations in the state.

In each case, the ewes and rams remained thrifty throughout the season and egg determinations in fecal samples showed a low degree of parasitic infestation. (Previous tests had

FIG. 60. HEALTHY EWES AND LAMBS THAT HAVE BEEN TREATED WITH PHENOTHIAZINE-SALT MIXTURE.

shown phenothiazine administered in capsules to be equal to standard treatments.)

In two cases, however, the lambs became unthrifty late in the summer and showed marked improvement in weight, condition and thrift after being drenched with "Cu-Nic" (a mixture of copper sulphate and nicotine sulphate). Probably these lambs were not consuming enough of the mixture to control the parasites during heavy infestation. The phenothiazine-salt mixture eliminates the periodic drenching or administering of capsules that are not only time consuming and hard on the animals but often inconvenient.

However, until it has been proved that phenothiazine will control all the different kinds of internal parasites it is advisable, in addition to furnishing a phenothiazine-salt mixture, to drench the flock once or twice a year with "Cu-Nic" which controls some parasites that phenothiazine apparently does not (Fig. 60).

TURKEYS AND POULTRY

Certain Families of Chickens Are Resistant to Coccidiosis

During the past year, sixteen matings of chickens were made and their progeny tested by artificial infection for resistance or lack of resistance. Some of the birds used the year before and their progeny were used again in these matings. With the results from the previous year's work, eight of these matings were made to produce resistant families and eight to produce susceptible families. The results from the testing of progeny from these sixteen matings demonstrated that susceptibility or lack of it existed in the families under test.

Collectively, the mortality in the eight susceptible families was about twice as high as it was in the eight resistant families. Statistically, there is no reasonable possibility that these results were secured by chance. This simply means that resistance or susceptibility to cecal coccidiosis is a family trait.

At this time it is not possible to say anything on the nature of the factor or factors that determine the inherited traits of resistance or susceptibility. Much more work must be done to make this possible. With closer selection in the two groups of birds it is expected that the spread in their mortality rates can be further widened. Practically all the birds used the past two years and additional progeny are available for further studies.

Livability of Leghorns Maintained At Good Level

A livability record of 88 per cent for twelve months was made during 1942-43 by pullets from a strain of White Leghorns bred especially for superior livability. As compared to this, only 79 per cent of the pullets from the control matings lived for one year. Parents of the second group were selected from families with mortality from various causes. The strain with superior livability was continued by using breeders from families having had no or very few cases of mortality.

Of the deaths occurring in the combined groups during 1942-43, over two-thirds were due to general conditions rather than specific diseases. Leukosis and cecal coccidiosis were the only specific causes of mortality and they accounted for only 26 out of 75 deaths.

The strain with low mortality was developed by testing complete fam-

ilies of pullets each year without culling, and by determining the causes of deaths as they occurred. For matings, breeders are selected from families that have had very few or no deaths. The poultryman who buys his replacement stock should deal with breeders who are emphasizing livability in their program.

Crossbreds Superior To Purebreds

Additional evidence has been obtained showing that crossbred pullets are somewhat superior to purebreds coming from the same parent stock (Fig. 61).

In these tests comparisons were made for mortality before and after sexual maturity, average days to maturity, percentage culled April 30, average production from sexual maturity to April 30, average production for those birds completing one laying year, broodiness, egg size, and body weights. No culling was done until April 30, when it became necessary to reduce numbers. Individuals with extremely low records were culled without regard to the breed or cross.

For almost every comparison the average performance of crossbreds was better than the average performance of the two pure breeds mated to produce them. Results show that considerable stimulation in livability and production factors can be expected from crossbreeding. As in the case of broilers, performance of crossbreds is influenced by the quality of the pure breeds crossed to obtain them.

In an experiment of thirteen groups of broilers raised for comparison, the crossbreds were not only heavier, but were completely feathered sooner, and showed less mortality than the purebreds. While the advantage in weight was not great on an individual basis, ranging from a half ounce to 6.7 ounces, the difference becomes very

FIG. 61. PART OF A GROUP OF ROCKS, REDS, ROCK-REDS, AND RED-ROCKS GROWN TOGETHER FOR COMPARISON.

important when multiplied by large numbers.

These results are similar to those from experiments conducted previously. It now seems definitely established that crossbreds will be superior to the purebred strains crossed to produce them. This does not mean, however, that crossbreds bought from one hatchery will be superior to the purebreds from another source. The quality of the crossbred depends on the quality of the purebreds combined to produce them.

Managerial Practices To Stimulate Egg Production May Be Disappointing

Carefully controlled tests on the effects of stimulating practices were conducted during the past four years at the Central Experimental Plant at Raleigh and at the Lower Coastal Plain Branch Station at Willard. These tests measured the influence of lights, pellets and wet mash on egg production from October to May. Rhode Island Reds and Barred Plymouth Rocks were used and the following results secured:

1. Total production from October through May by Barred Plymouth Rocks and Rhode Island Reds was not significantly affected by the use of lights, wet mash or pellets.

2. Throughout the period of test, pens that received supplements of wet mash or pellets showed the same trends in production as the control pens, while the lighted pens showed a distinct seasonal difference from the other treatments.

3. During October, November, December and January, the lighted pens of Barred Rocks gave higher production than the control pen, while during February, March, April and May the control pen gave higher production.

4. For the Rhode Island Reds tested, the lighted pen was significantly superior to other treatments only during January, and significantly inferior to the control pen during March and April.

Careful Breeding Is Necessary for Profitable Performance

Studies conducted at the Central Station Experimental Plant and at the Lower Coastal Station at Willard show that by careful breeding, profitable characteristics can be bred into and maintained in poultry flocks.

In the Rhode Island Reds at Willard and at the Central Experimental Plant in Raleigh, intensity of lay, egg size, body weights and earliness of sexual maturity were maintained in the laying year, 1942-43.

In the Raleigh flocks, laying house mortality (first six months of lay) was maintained at 8.9 per cent in 1942-43 as compared with the same figure for the two preceding years, and was reduced in the Barred Plymouth Rocks from 7.5 to 7.2 per cent.

At both Stations there was a drop in the number of eggs produced in the first six months of lay as compared with the two preceding years. The Rhode Island Reds at Willard dropped from 115.5 to 110.9 eggs per bird; the Rhode Island Reds at Raleigh from 128.2 to 120.6 and the Barred Plymouth Rocks at this Station from 111.4 to 93.7. As careful breeding programs have been carried out in all years, the reductions, occurring as they do in all three groups, indicate a possibility of a reduction in feeding value of the war-time feeds as compared with those of the pre-war period.

Turkeys Are Valuable As Breeders In the Second Year

For breeding purposes the value of turkey hens carried beyond the first year is of importance to the industry. Not only are such birds of value from the standpoint of hatching eggs pro-

duced but also their ability to live for this period of time should denote superior constitutional vigor in themselves and the ability to produce stock of high vigor.

Twenty-seven birds have been trapnested for two years or more at the Turkey Experimental Farm. These birds averaged 115 eggs for the first year's production and 72.2 eggs for the second year or a 62.8 per cent production of the first year. One bird even laid more heavily in the second year than in the first.

The range in the percentage of first year production ran from 22.5 to 110.9 per cent. Variations within this range about parallel those that are expected in the second year's production by chickens where it has been established that proven breeders in the pullet year are valuable for a second year's work. It should be stressed, however, that selection of turkeys for a second year's work must be based on accurate records of the first year, preferably by trapnesting.

Broodiness is Factor in Number of Eggs Produced by Turkeys

The producer of turkey eggs for hatching wants to get as many eggs per breeder as possible during the relatively limited hatching season. Broodiness, however, is far more prevalent in turkeys than in chickens. The chief reason for this is that very little trapnesting work has been done with turkeys and so there are only a very limited number of breeders with family information accurate enough that they can breed away from this undesirable characteristic.

At the Turkey Experimental Plant, all layers are trapnested and complete family records kept on their progeny. The index of broodiness for the laying year of 1942 shows that for the months of April-August, inclusive, 2,842 or 13.5 per cent of 21,008 hen-days were lost because layers were broody.

For the same period in 1943, 3,044 or 11.9 per cent of 25,607 days were lost because of broodiness. This represents a reduction of 11.6 per cent in total days lost because of broodiness. The reduction was brought about by selecting breeders to reduce broodiness. Forty-seven families under study in 1943 showed ranges in broodiness from 0.2 to 28.8 per cent.

Lights Make Turkeys Lay Earlier

Studies on sexual maturity (number of days elapsing from time of hatch until the first egg is laid) confirm the report made in 1942 that the later the time of hatch, the less number of days required by the birds to come into production. No progress has been made in reducing days to sexual maturity on the basis of selection.

Because of these disappointing results lights were installed in the breeding pens in 1943. The lights were started December 1 and the length of day increased so that by December 10 the lights were on from 4 a.m. until daylight. Egg production under these conditions began sixty days earlier than in past years when no lights were used.

Studies To Detect Carriers of Pullorum Disease In Turkeys

Pullorum disease in turkey poults is on the increase. Main source of this infection is through hatching eggs laid by infected breeders. But it also spreads in the incubator and brooder houses.

To prevent the disease it is necessary to detect infected breeders and remove them from the flock. Certain blood tests (agglutination tests) are suggested to detect these breeders, but there is still some question on the efficiency of these tests.

At present a study is being made to determine the efficiency of the rapid

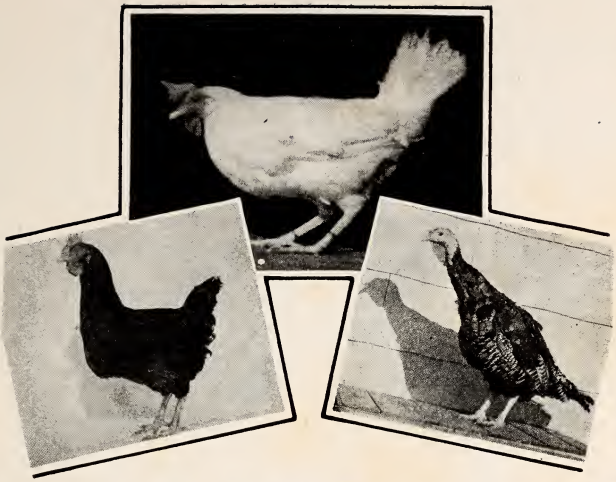


FIG. 62. HIGH PRODUCING BIRDS DEVELOPED AT THE STATION. RHODE ISLAND RED (LEFT): BRED AND DEVELOPED AT CENTRAL EXPERIMENTAL PLANT. LAID 333 EGGS IN 365 DAYS. THE HIGHEST RECORD YET DEVELOPED IN RHODE ISLAND REDS AT THE CENTRAL PLANT. TURKEY (RIGHT): LAID 430 EGGS IN FOUR LAYING YEARS. WHITE LEGHORN (CENTER): BRED AND DEVELOPED AT CENTRAL PLANT AND MAINTAINED AT MOUNTAIN STATION FOR RESEARCH PURPOSES LAID 334 EGGS IN PULLET YEAR AND FINISHED FIRST HEN YEAR WITH A TOTAL OF 601 EGGS IN TWO YEARS OF LAY.

whole-blood stained-antigen test and the tube agglutination test to detect infected breeders. For the rapid whole-blood test, four commercial testing fluids (antigens) and one USDA experimental testing fluid are being used. For the tube test, a testing fluid similar to that used in the detection of pullorum disease in chickens is employed. Following artificial infection and a series of blood tests, the internal organs of the inoculated birds are examined for the presence of the pullorum germ.

While more birds must be studied before the comparative efficiency of the various antigens to detect "carriers" of pullorum disease can be determined, present results show that a strong blood reaction (agglutination) to the so-called T.G. stained antigens and the USDA experimental stained antigen, and complete agglutination of the tube test antigen in a 1 to 25 dilution is indicative of infection. Such reactors should be removed from the breeding flock.

Vitamin Content of Pork Changes With Cooking

Pork is an excellent source of thiamine and a fair source of riboflavin (Vitamins B_1 and B_2). However, when pork cuts are prepared for the table, because of the relatively high temperatures used, one might expect a considerable loss of these two vitamins.

Actual experiment, though, has shown that when pork cuts are roasted to an internal temperature of 85° C., a large percentage of both riboflavin and thiamine remain in the meat.

It was noted that 80 per cent of the riboflavin and 70 to 80 per cent of the thiamine were retained in the meat after roasting. It was also of interest that the riboflavin content of the tenderloin muscle was twice that of the rib eye muscle.

Beef Muscles Vary In Vitamin Content

Differences have been found between the riboflavin (Vitamin B_2) content of various muscles within different cuts of beef. These differences, however, are not as large as those in pork muscles.

Differences were found in the riboflavin content of twenty different muscles from four cuts of beef. One muscle in the prime rib, for example, had 46 per cent more riboflavin than another muscle in the prime rib. Similar differences were noted between muscles of the various other cuts. The content of riboflavin was significantly lower in the muscles of the round than in the muscles of the prime rib and the short loin.

Sweet Potatoes Are Good Source Of Carotene and Vitamin C

The importance of the sweet potato as a source of vitamin A (carotene) and vitamin C (ascorbic acid) has not been sufficiently emphasized. It is not generally realized, for example, that the yam has a vitamin A potency from one to two times as great as that of the best summer butter, nor that as a source of vitamin C, it is half as good as fresh orange juice or lemon juice and equal to that of tomato juice.

A Porto Rico variety of sweet potato studied during the past year contained between 3.4 and 5.3 mg. carotene per 100 grams of fresh tissue (10.0 to 15.9 mg. per 100 grams on a dry basis). There was no significant loss in carotene during 168 days of storage.

The same potatoes contained 22.0 to 25.6 mg. ascorbic acid per 100 grams fresh tissue (65 to 75 mg. per 100 grams, dry basis) just after curing and for one to two months thereafter. After this time, ascorbic acid tended to disappear so that after five to six months' storage, the potatoes contained from 15.9 to 19.8 mg. per 100 grams fresh tissue (47 to 58 mg. per 100 grams, dry basis).

When sweet potatoes were baked, either when freshly cured or after four months' storage. they lost water and carotene at practically the same rate, so that baked potatoes contained essentially as much carotene as raw roots, on the wet basis. When compared on the dry basis, however, baking caused a loss of 15 to 17 per cent of the carotene. After boiling, the average carotene content was 12.5 mg. per 100 grams, on a dry basis. This represents a loss of 7.1 per cent.

Boiled or baked sweet potatoes contained, on an average, the same amount of ascorbic acid on the wet basis, 25.9 and 25.5 mg. per 100 grams, respectively. On a dry basis, baked potatoes had an average ascorbic acid content equal to that of the raw po-

tatoes, or 64.3 and 63.3 mg. per 100 grams, respectively.

Lespedeza Is Rich In Carotene[1]

Tests with three varieties of lespedeza show that up to and including the early bloom stage, Korean lespedeza contains slightly more carotene (pro-vitamin A) than Kobe, which, in turn, contains slightly more than the common variety.

However, by the middle of September when all are blooming, but the Korean has passed well beyond its full bloom stage, it is no richer in carotene than the common. At any rate, the differences in carotene content, both between varieties and at the different stages of growth, are so small that for all practical purposes they are unimportant.

Increase Feed Nutrients In Mountain Pasture Grass[1]

During 1942, which was a fairly normal year in well-distributed rainfall, yields of pasture grass and its nutrients increased many fold over those of the three previous dry years. This was shown in a study of Halewood mountain loam, fertilized with limestone and phosphate.

The fertilized pasture produced 1,098 pounds more dry matter, 213 pounds more protein, 10 pounds more calcium and 5 pounds more phosphorus per acre for livestock during the more average season of 1942 than the average of the three dry years, 1939 to 1941.

With the yields resulting from the application of limestone and phosphate compared to no treatment, the average 1942 season (with well-distributed rainfall) amounted to 10 times as much dry matter containing 9 times as much protein, 10 times as much calcium and almost 5 times as much phosphorus per acre as the average increase for the previous three years.

The percentage of increase of nutrients in the grass varied from 26 to 59, probably due to an unusually good stand of white clover.

The total carotene (vitamin A) was not affected by phosphates, but limestone increased the yield 63 per cent during early and late summer. Neither limestone nor phosphate increased the percentage of carotene in the mixed pasture grasses.

Soybeans and Cowpeas As Sources of Riboflavin

The vitamin, riboflavin, formerly known by the name of vitamin B_2 or G, is apparently needed by all animals, including man, and even by a large number of bacteria. It is, therefore, important that more information be obtained on the riboflavin content of various foods and feeds.

In a study of 164 samples of soybeans and 17 samples of cowpeas, the average riboflavin value (in micrograms per gram) was 2.96 for soybeans and 1.59 for cowpeas. These values compare very favorably with those of many other feed materials. Thus, barley, corn, oats, or wheat contain 1 microgram of riboflavin per gram or less.

Continuing the study of the factors that may influence the results of a riboflavin assay by the rat-growth method, it was found that the addition of cystine to the daily dose of cowpeas or soybeans caused the rats to make slightly greater gains in weight. This shows that the quality of the protein supplied by the basal ration, together with cowpeas or soybeans, can be improved by the addition of cystine, especially when large doses of the peas or beans are fed daily.

Cooking did not increase the apparent amount of riboflavin in either cowpeas or soybeans. This is in contrast to the findings of the New Mexico

[1] Cooperation. Tennessee Valley Authority.

Agricultural Experiment Station that cooking increases the available riboflavin in pinto beans.

The rat-growth method sometimes yields riboflavin values considerably higher than those obtained by the photofluorometric method, especially with soybeans. The reason for this variance has not yet been determined.

FIG. 63. ROW GRADE PLOTS EQUIPPED WITH AUTOMATIC RECORDERS AND TANKS FOR DETERMINING THE AMOUNT OF RUNOFF AND SOIL LOSSES WITH DIFFERENT ROW GRADES. SOIL CONSERVATION EXPERIMENT STATION.

SOILS and FERTILIZERS

SOIL CONSERVATION

Excessive Row Grade Increases Soil Losses[1]

The importance of contour tillage is emphasized by three years' results of a row grade experiment at the Soil Conservation Experiment Station near Raleigh. (Fig. 63.)

The amount of soil lost from row crop land tends to increase rapidly with the grade as shown in Figure 64. And soil losses with grades of 2 per cent (24 inches per 100 feet) or greater are inclined to become serious. It is quite obvious that up-and-down hill tillage, commonly practiced by many farmers, can soon become destructive and is responsible for much of our eroded land.

Laboratory data suggest that water velocity and depth, as related to the texture of the soil, are the important factors. At the lesser slopes water depth seems to be the important factor causing erosion and at greater slopes, water velocity becomes more important.

The amount of runoff, however, does not increase with the grade, since about as much surface water runs off with 6-inch and 12-inch grades as with 24 or 30 inches. In tobacco-farmer language, this means that a lot of "fall" is not necessary for tobacco rows and that moderate row grades will provide good drainage.

Velocity is materially stepped up as the row grade increases, as the experimental results have shown. This, no doubt, accounts for the rapid rise in soil loss on the steeper grades.

[1] Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

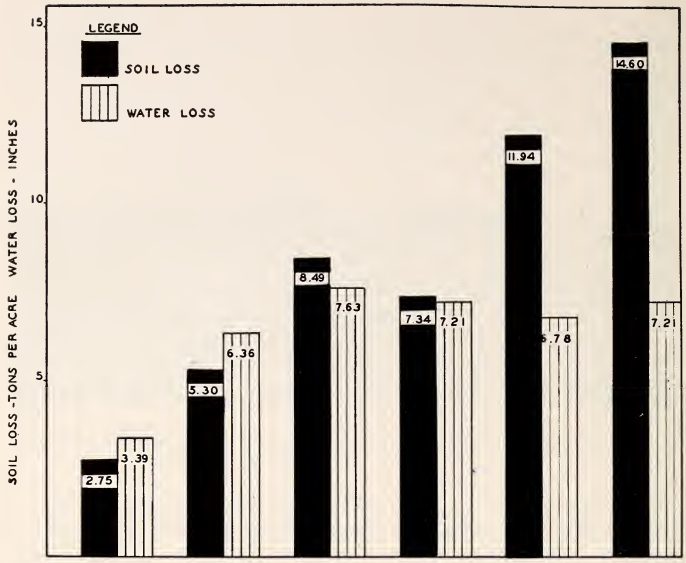


FIG. 64. EFFECT OF ROW GRADE ON RUNOFF AND SOIL LOSS. DATA INCLUDE AVERAGE OF THREE YEARS' RESULTS FROM DUPLICATE PLOTS.

Coarse Soils Erode Easily[1]

On the Soil Conservation Experiment Station Row Grade plots the finer soil fractions were eroded relatively more and the coarse fractions relatively less than they occurred in the soil. High intensity rains increased the percentage of coarse material eroded. The largest percentage of coarse material eroded was on the plots with the least slope (level) and the greatest slope (30 inches per 100 feet of row). A smaller percentage of coarse material was eroded from the 18-inch slope than from any other.

Within the sand fractions, some of the coarser grades were eroded in much larger amounts than they occurred in the soil. On the 12-inch grade relatively more very coarse sand was eroded than was present in the soil. This was not true on the 18-inch grade, thus indicating that tobacco row grades should be adjusted in accordance with the soil texture.

Cover Crops Reduce Soil Loss[1]

Turning under rye, ryegrass, or other cover crops increased the value of bright tobacco approximately $50 per acre and reduced soil loss to approximately one-half of that where no cover was used in a cover crop-tobacco experiment.

The 5-inch rain of June 8 and 9, 1943, caused a soil loss of 10 tons per acre where no winter cover was

[1] Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

used. Where a winter cover of rye and ryegrass was turned, the soil loss during this rain was only slightly more than 5 tons per acre.

Results show that these heavy storms account for around three-quarters of the total annual soil loss. It is during the period of these summer storms that erosion control practices are most needed.

Tobacco Farmers Like Improved Row System[1]

The use of the new "string method" of laying out tobacco rows on terraced fields is proving highly satisfactory as shown by field trials conducted in cooperation with county agents, Soil Conservation Service technicians, and a number of tobacco farmers.

The new method provides continuous row drainage and helps to prevent row breakage and the choking of terrace channels with sand. Farmers using the row system report good drainage, with no drowning, and a more uniform growth of tobacco. This resulted in a corresponding increase in the yield and value of the tobacco crop.

In laying out the system, a guide row is first laid out, which, beginning opposite the channel crest, parallels the upper terrace in narrowing sections and parallels the lower terrace in widening sections. All other rows of the interval parallel this guide row.

Surface Mulch Experiment Begun[1]

Recent interest in different parts of the country on the use of surface mulches with subsurface tillage of crop land has led to a new experiment to compare this practice with normal tillage methods in three different cropping systems.

A 3-year rotation of corn, wheat, and lespedeza, a continuous double-cropping of wheat and lespedeza, and continuous corn and winter cover are used. This experiment will be followed with interest, for it has possibilities of becoming an effective soil-conserving practice if it is found practicable for North Carolina's type of farming.

[1] Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

SOILS

Many Crops Require Boron In Eastern North Carolina

SWEET POTATOES require more borax as a preventive of cracking than was recommended on the basis of earlier work. This year's experimental work shows that applications of 10 pounds an acre in the row with the fertilizer have caused no damage even on strongly acid soils low in lime.

Twenty pounds an acre on such soils may produce a temporary injury to plants as shown by a yellowing between the veins and a burning around the margins of the leaves. Where this is not too severe, the symptoms soon disappear and a better crop is made than where no borax is applied. For soils high in lime, 20 pounds of borax an acre is needed and will cause no injury. On very light sandy soils it appears that borax may be lost by leaching during heavy rains. If this happens early in the season, it is best to sidedress the sweet potato plants that have started to grow well, with 5 or 10 pounds of borax to the acre, mixed with a small amount of fertilizer.

CABBAGE grown in the Eastern counties is greatly improved by liberal fertilization with borax. Ten pounds an acre is a minimum rate of application on acid soils and if the lime

content of the soil is high, 20 pounds should be used. In the round-headed type of cabbage, the need for borax is most commonly shown by the frequent occurrence of hollow stems. Less apparent, but equally serious evidence of boron deficiency is the failure of the outer leaves to cover the head well. Without sufficient borax, the pointed head types of cabbage produce crisp, brittle leaves that are easily damaged in handling and shipping. This defect has been corrected by an application of borax at 10 pounds per acre.

BLUEBERRIES will respond to moderate amounts of lime if the lime is supplemented with other treatments, including borax. Even on strongly acid soil the tolerance of blueberries to the borax is very high. A broadcast application at a rate of 60 pounds an acre has caused no injury to newly set plants in soils having a pH of 4.0. Older plants were not damaged on soil of the same pH by an application of borax made at a rate of 25 pounds an acre immediately around the base of the plants.

BROCCOLI of the heading type also has a high boron requirement. On soils high in lime it is necessary to supply more than 10 pounds of borax an acre to prevent hollow stems and cracking of the midribs of the leaves.

STRAWBERRY varieties, that are otherwise desirable, cannot be grown successfully in Eastern North Carolina because of the formation of multiple fruits. Borax, applied at the rate of 5 pounds an acre has effectively prevented this condition in the Fairfax and Eleanor Roosevelt varieties. (Fig. 65.)

FLOWERING BULBS hitherto grown successfully only on strongly acid soils can now be raised in soils at pH 5.5 to 6.0 if 5 to 10 pounds per acre of borax is supplied in the fertilizer. Without borax the leaves of these plants often become yellow and abnormally thick and crisp. The addition of 1 to 2 pounds of borax to 50 gallons of bordeaux spray has corrected this condition in bulbous iris within a period of five days after the spray was applied and some growers are now making a regular practice of adding borax to their spray mixture.

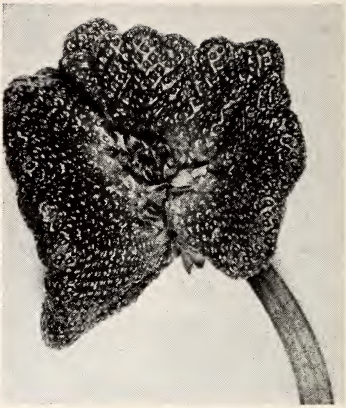


FIG. 65. MISSHAPEN FRUIT WITHOUT BORAX.

Superphosphate Injury

Phosphates, applied to the dark gray or brown organic sandy soils of the Eastern part of the State, will lower the oxidation level of such soils and may cause serious injury to crops, especially in periods of temporary waterlogging. In soils having red or yellow subsoils indicative of a high iron content, phosphates should not cause serious injury as the iron will retard the development of a reductive soil condition.

Residual Effect of Fertilizer Applications Observed

The effect of potash applications

made to the soil on the Lower Coastal Plain Experiment Station during the 1915-37 period was still observable on lespedeza in 1943 even though this field has been fertilized uniformly with a complete fertilizer for six years. Lespedeza on plots receiving no potash during the 1915-37 period showed marked symptoms of potash deficiency last season and yielded considerably less than did those comparable plots which received potash during this earlier period.

Applications of approximately 20 pounds available potash (comparable to that contained in 400 pounds of a 5-10-5 fertilizer) annually for six years had not overcome the exhaustion of potash from the soil that had occurred during the previous 23 years sufficiently to permit satisfactory growth of lespedeza. Soil samples from these plots are being analyzed in the laboratory and tests on the available potash supplies in the soil support these observations.

Effects of Pasture Sods On Soil Productivity[1]

Chemical studies on a Norfolk fine sandy loam soil seeded to different pasture sods in 1937 show that fertilization and liming affect greatly the plant nutrients in the soil.

In a study of soils collected from a Dallis grass-lespedeza sod it was found that the amount of organic matter and available phosphorous that accumulated was greatly affected by the treatment, as shown in Figure 66.

A Dallis grass-white clover sod fertilized with a complete fertilizer, including lime, contained 46 per cent more organic matter than a nearby sod that had neither fertilizer nor legumes.

The addition of lespedeza to a Bermuda grass sod increased the organic matter, over the grass alone, whereas carpet grass was not affected by lespedeza. Plant population readings have shown that lespedeza grows much better with Bermuda grass than with carpet grass.

Results from these studies indicate that maximum increases in soil organic matter and nitrogen can be expected by the use of a complete fertilizer, including lime, on a grass-legume sod.

Cotton, Soybeans, and Peanuts Affected By Nature of Clay and Amount of Calcium

Greenhouse experiments with soil sand mixtures containing colloids (very fine material) of two types of clay (montmorillonitic and kaolinitic) and one type of organic matter (muck) showed that the growth and mineral absorption of soybeans and cotton differed markedly for any certain degree of calcium (lime) saturation depending upon the nature of the fine material (colloid).

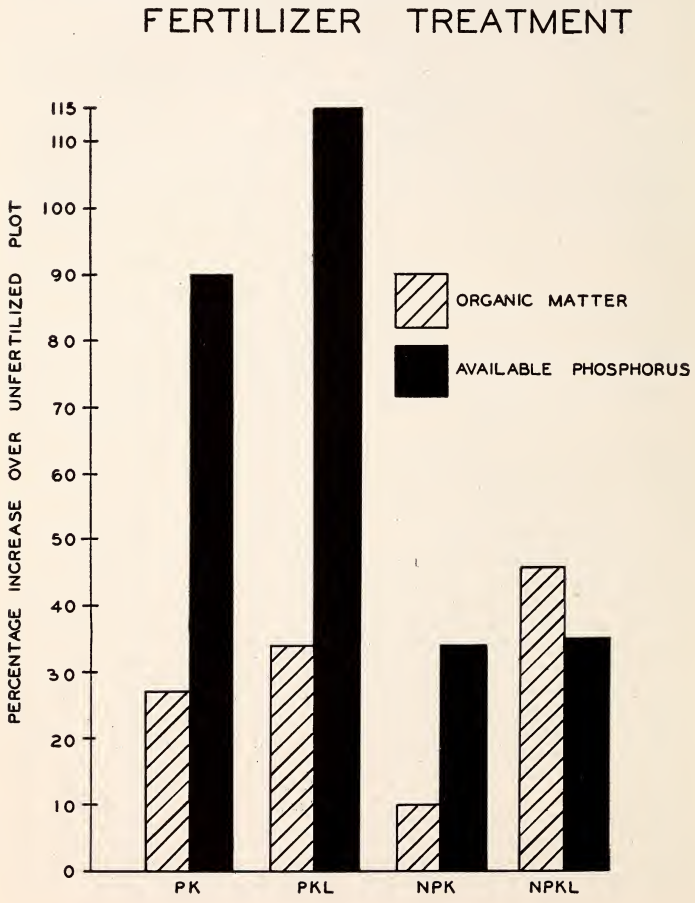
The results obtained with soybeans are illustrated in Figure 67. For any given degree of calcium saturation the total amounts of calcium per pot were the same for the four soils shown. The only difference was in the nature of the colloids present in each soil. The Durham soil is representative of the kaolinitic type of clay, the White Store soil of the montmorillonitic type of clay, and Muck of the organic type. The Creedmoor soil contains a mixture of about equal parts of kaolinite and montmorillonite clay. The illustrations show that good growth of soybeans are obtained above 40 per cent calcium saturation on Durham and Muck, above 60 per cent on Creedmoor and at 80 per cent on White Store. The results with cotton were identical.

Analysis of the plants showed that the uptake of calcium was directly

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

related to the growth response as shown in Figure 67. This indicates that growth was dependent upon the availability of calcium since all the other nutrient elements were supplied in adequate amounts. The results also show that the relative availability of calcium varies with different kinds of colloidal or fine material in the soil. The nitrogen content of the soybeans increased with the degree of saturation of the soil with calcium.

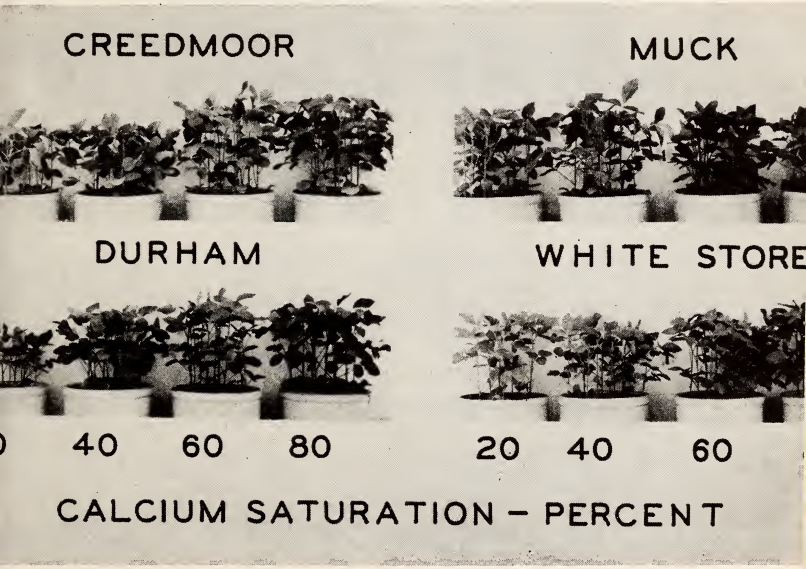
FIG. 66. SOIL PRODUCTIVITY RELATED TO PREVIOUS TREATMENTS.



The effect of the nature of the colloid on the relative availability of calcium was studied also with peanuts. The peanuts took up increasing amounts of calcium with increasing degrees of calcium saturation. They absorbed consistently more calcium, however, from the kaolinite type of clay than from the montmorillonite type.

The ammonia content of the soil varied some with the different crops but rapidly decreased from early February until the land was plowed early in April. It then increased rapidly from three or four pounds per acre to about 20 or 25 pounds per acre by the middle of May. Following vetch and crimson clover it was about five pounds higher. It remained at that

FIG. 67. PHOTOGRAPHS OF SOYBEANS GROWING IN 4 DIFFERENT SOILS WITH INCREASING PERCENTAGES OF Ca SATURATION.



Cover Crops Supply Available Nitrogen[1]

Determinations were made of the amount of ammonia and nitrate released by seven cover crops preceding tobacco. The crops were vetch, crimson clover, soybeans, cowpeas, lespedeza, wheat (crabgrass following) and fallow (crabgrass).

level until the latter part of August when it dropped to about 15 or 20 pounds and then increased again in the early fall after the tobacco stalks were disced in and grain seeded. During the tobacco growing period there was very little difference in the am-

[1] Cooperation. Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. Department of Agriculture.

monia content of the soil on the fallow, wheat, lespedeza, soybean and cowpea plots.

The nitrate level was about six to eight pounds per acre in all plots in the early spring. By the first of May it was almost zero. However, during May it increased rapidly to about 22 to 28 pounds per acre on all except the vetch and crimson clover plots on which it rose to approximately 40 pounds. During June and July the nitrate declined, but the level remained higher on the vetch and crimson clover plots. Since the nitrate content of the soil on the summer legume plots was only a few pounds greater than on the check plots, it appears that an adjustment in the fertilizer ratio, together with earlier plowing, would make possible production of good flue-cured tobacco, where legumes are grown in the rotation. The earlier plowing would give the decline in nitrates at the time when the tobacco should be maturing.

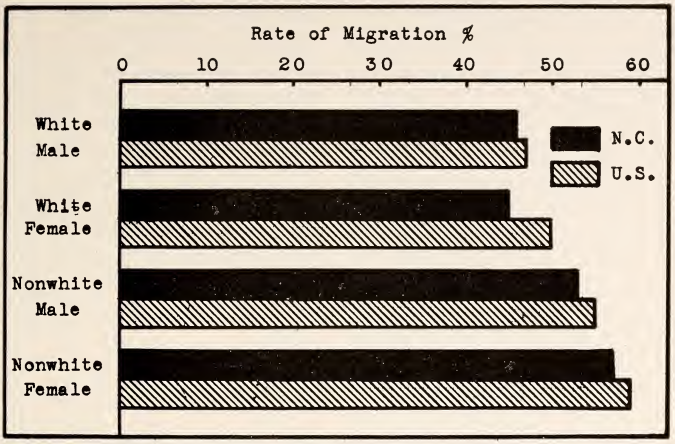


FIG. 68. RATE OF NET MIGRATION FROM FARMS, 1920-1940, NORTH CAROLINA AND THE UNITED STATES.

ECONOMIC and SOCIAL PROBLEMS

SOCIAL PROBLEMS

Twenty Years of Migration From Farms

In 1920, the United States Census found 206,344 youths 10-14 years of age living on the farms of North Carolina. Twenty years later, only 95,227 people 30-34 years of age were on the farms of the state. Obviously, 111,117 young people had disappeared from farms during the two decades because of death or migration.

The records show that death took 22,417 or nearly 11 per cent of the original group. Therefore, had no migration taken place at all during the period, there would have been 183,227 survivors of the original 10-14 age group. But since only 95,227 were actually living on farms in 1940, 88,700 youth (net) must have migrated to cities or to other states.

This net loss from farms by migration represents 48.2 per cent of the survivors of the 10-14 age group. Since this is a net figure (that is, the difference between the total *off* and *on* movements), *at least one out of every two of these youths on North Carolina farms in 1920, left the farm be-*

fore 1940.[1] This is a startling figure, but as a matter of fact, the rates of migration from farms of other states, and of the nation as a whole, were higher. Figure 68 shows 20-year net rates of migration by the 10-14 group from farms of North Carolina and of the nation by sex and color.

Other age groups do not show such extremely high rates of migration because the 10-14 group is the only one that passes almost completely through the period of heavy migration.

The annual contribution of North Carolina farm youth to the state and nation is approximately 25,000 people. The Metropolitan Life Insurance Company has recently compiled figures to show that it costs about $10,000 to rear a child from birth to 18 years of age. If this is true, then the money value of the annual migration is greater than the annual net cash farm income in North Carolina in most years!

The conclusions to be drawn from these data are:

1. Since at least half of our farm youth have left and will likely continue to leave the farms, our rural educational programs should place just as much emphasis on urban living and on nonagricultural occupations as on rural living and on the agricultural occupations.

2. Since the farms contribute to the towns and cities such a great wealth of human resources, the towns and cities of the state and nation should see to it that rural social and educational services are maintained at a high level of efficiency.

3. Our social and educational agencies should help to guide farm to city migration. Too many farm youths are poorly equipped to work and live in the city.

[1] It is assumed that those who died during the 20-year period migrated, while living, at the same rate as those who lived through the entire period.

Rural Industrialization Creates New Problems

The effect of industrialization on the rural community is revealed in recent survey of the neighborhood around the Alexander-Wilson school in Alamance County.

Before industry came to Alamance County, this area was almost entirely agricultural. Now 33.3 per cent of the workers of this still open-country neighborhood are employed full-time in industrial and mechanical occupations; 5.6 per cent are white collar workers; 35.2 per cent are farming part-time; and only 25.9 are farming full-time.

The part-time farmer group ranks high in home ownership, 84.2 per cent being home owners as compared with 78.6 per cent for the full-time farmer group, and only 38.9 per cent for the industrial-mechanical group.

However, the industrial-mechanical group ranks high in automobile ownership—41.5 per cent as compared with 37.9 per cent of the part-time group. Nonowners of automobiles ride to work with their neighbors or use the rural bus or station-wagon services. The wartime restrictions on gas and rubber, although inconvenient and potentially serious, have not seriously interferred with the necessary transportation of these rural people to and from their places of work.

Housing space appears to be the most serious consequence of the industrialization of this area. Part-time farm households are the largest of all, having 5.7 persons per house, and because of this most frequently live "doubled-up," that is, more than one family or couple per house. Full-time farm families average only 4.5 persons per house.

Social participation and the development of community-wide organizations is increasingly handicapped by industrialization that brings families of widely varying interests and work-

ing schedules into the area. Case analysis of families summarized below reveals that there is a close relationship between household characteristics and participation in community and neighborhood activities.

The part-time farmer group has the following characteristics that lead to group participation: high social standing, stability of residence, possession of facilities that lead to participation, and a secure type of family situation.

However, other characteristics that do not lead to participation are lack of leisure, employment of wife, and, most significantly, the dual-occupational role maintained and the rather mixed environment in which the part-time farmer lives. His interests are not localized and in one field, but are divided between the factory and farm, between town and country. His neighbors, usually farmers and industrial workers, have interests different from his own, and spend most of their time working at various occupations in scattered locations. These divisions prevent unity within his community and do not encourage group ideas and group effort.

In communities of varied occupational composition, long time social planning should emphasize:

1. The development of strong community centers near the people;
2. The expansion of activities of local institutions: i.e., schools, churches, government;
3. The welding together of diverse groups through appeal to common human interests, namely, food-raising, child care, home improvement, hobbies and recreation, religion and worship;
4. Organizations *within* the community to meet needs of special interests now only partially met by *outside* agencies;
5. The development of organizations and activities to promote habits of group participation among children and young people.

More About Farm Labor Shortages

During recent months, agricultural leaders of North Carolina have focused attention on the farm labor situation in the state. Unfortunately, most of the talk has been based upon observation in local areas rather than on a complete picture of existing conditions.

There is not, however, a labor shortage on all farms. Three out of every ten farms have a labor shortage. The remaining seven have more than enough surplus labor, if it could be distributed, to meet the deficit on the others. Less than 15 per cent of the small farms, those under 12 war units, have a labor shortage as compared with 58 per cent for the larger farms with 32 or more war units.

The adequacy of the labor supply varies according to the size of farm. In general, the labor supply is more adequate for the small than for the large farms. The farms qualifying for less than 12 war units need less than half of their available labor. Farms qualifying for 32 or more units actually have 4 per cent less labor than they need.

Farms with less than 12 war units form 45 per cent of all farms, need 25 per cent of the total labor, but have 34 per cent of it. Farms qualifying for 24 or more war units comprise only 22 per cent of all farms, need 45 per cent of the labor, but have only 37 per cent of it.

On farms with a labor shortage, the labor available is, on the average, only 72 per cent of the labor needed. The few small farms having labor deficits have only half of the labor needed. This peculiar situation prevails because the loss of one man from a small farm represents a major part of its labor force.

The age and sex composition of the labor supply reveals an important condition. Thirty-six per cent of the manpower, that is, man-equivalents, is composed of males of draft age. Women, forming 45 per cent of the labor force, represent only 21 per cent of the effective manpower. Children under 14 years of age comprise 12.3 per cent of the labor force, but only 3.7 per cent of the manpower. People 65 years of age and over form 4.3 per cent of the labor force, but only 2.1 per cent of the manpower.

Therefore, if all eligible men of draft age were drafted, the effective manpower on farms would be reduced by 36 per cent. Actually, this figure is more important than its mere size indicates because the effectiveness of a large proportion of the remaining labor would be greatly reduced by the reduction of male workers.

The farm labor situation is more serious in Eastern than in Western North Carolina. The Mountain area needs only 40 per cent of its available labor; the Piedmont needs 79 per cent; Coastal Plain, 87 per cent; and the Tidewater, 90 per cent. Only 11 per cent of the Mountain farms have a labor shortage, as compared with 33 per cent of the Piedmont, 41 per cent in the Coastal Plain, and 34 per cent in the Tidewater.

These facts clearly show the need of continued good management if maximum production goals are to be met and maintained. Every farmer must look over his own situation and adjust his labor force and farm enterprises so as to combine them most efficiently for war production. Each neighborhood, community, county or region is small enough so that the free movement of labor, equipment, and efficiency ideas can be interchanged as critical areas and seasons demand. State and national governments have equally important parts to play and functions to perform if there is to be food and feed enough at the right time.

Agricultural Interests of Nonfarm Rural Leaders

An encouraging note in the relationships between agricultural and town life is that so many of the outstanding professional and business men living in villages and towns were reared on farms and retain a fundamental interest in agriculture.

In a study of 385 white leaders in four rural counties[1] of North Carolina, it was found that 162 of the men had a second occupational field. Of these 162 men, 20 were farmers by first or major occupation, the remaining 142 were in various businesses and professions. All but seven of these owned, and closely supervised the operation of farms. Over one-half of the 87 business men included in the survey owned farms in addition to running their businesses. Exactly one-half of the 40 physicians found enough time and interest to own, and at least to supervise the operation of farms. Almost one-half of the 56 lawyers and over one-third of the 45 school men were also actively engaged in farming as a secondary occupation.

It is evident that agricultural activity absorbs a relatively large proportion of the time and interest of rural leaders. This tie-up between the nonfarmers by primary occupation and the agricultural world is important. It gives to rural life a type of leadership that is good and that at the same time has direct non-agricultural contacts.

Although these men have left the farm, the liking for farm life has never left them. They understand farmers and agricultural problems. They are well fitted through experience and interest to work with full-

[1] Chatham, Franklin, Johnston, and Sampson.

time farmers on current programs and to cooperate with them in the solving of short- and long-time problems of Southern agriculture. This experience and interest should be used to an increasing extent in the development and carrying out of war and post-war agricultural programs.

ECONOMIC PROBLEMS

The Effect of Mechanization On the Use of Man Labor[1]

A preliminary study of farm mechanization in the Northern Coastal Plains Area reveals some interesting facts regarding the use of farm labor. On farms where mules are the only source of power it required 134.5 hours of man labor to produce one acre of cotton as compared with 107.9 hours on farms using tractors as the major source of power. This is a reduction of 26.6 hours of man labor per acre on the mechanized farms.

The largest relative reduction in man labor requirements is in the preparation of the seedbed and planting; the largest absolute reduction, in cultivation. Since the harvesting of cotton is as yet not mechanized, labor requirements are the same on mechanized and non-mechanized farms.

Peanut production is slightly more adaptable to mechanization than is cotton. Labor requirements on this crop are 16.0 hours or 23.9 per cent less on mechanized than on non-mechanized farms. The largest relative, as well as the largest quantitative, reduction in man hours, is achieved in preparing the seedbed and in planting. Labor required for cultivating, hoeing, and fertilizing is less on the mechanized farms. The labor requirements for harvesting are reduced when tractors are used for plowing up the nuts.

Corn is very adaptable to mechanical operations, but very few corn pickers are in use in the area.

Small grain production is definitely adapted to mechanized operations and man labor per acre under mechanized conditions is reduced over one-half from that required on non-mechanized farms. The actual labor required on non-mechanized farms is 14.3 hours and on mechanized farms, 6.1 hours. Nearly all this reduction is in the preparation of the seedbed and planting. Since harvesting is done with a combine in both cases, there is little difference in man labor requirements for harvesting between mechanized and non-mechanized farms.

Marketing Eggs In North Carolina

An investigation of the quality and price of eggs shows that 42 per cent of those sampled during the first six months of 1943 were Grade A, whereas 49 per cent were Grade B, and 9 per cent were Grade C.

Within these grades, 18 per cent were either dirty or light dirty, and as percentages of all eggs, one per cent contained blood spots, 2 per cent were checks (cracked) and one per cent were inedible.

In many cases, the good and bad eggs were not equally divided, one or the other were to be found in greater numbers. In one market only 23.5 per cent of the eggs sampled were Grade A, of which over half were light dirty. Approximately 26 per cent were Grade B, 34 per cent Grade C, over one-half of these were dirty and light dirty, 6 per cent were inedible, 5 per cent were checks, and 5 per cent contained blood spots.

The quality of so-called "country"

[1] Cooperation: Bureau of Agricultural Economics, U. S. Department of Agriculture.

eggs appears to be as good as "town" eggs. Town eggs were found to be more uniform in size and to include more large eggs and fewer small ones than eggs sold at country points; however, approximately 53 per cent of town eggs were large as compared to 48 per cent for the country. On the other hand, country eggs seemed to be slightly cleaner, and relatively fewer were inedible.

Cost of Growing Truck Crops

The armed forces and civilian population are demanding more truck crops, and since these cannot be supplied in the quantities demanded unless prices paid to growers are high enough to cover the cost of production, a study of the cost of producing the principal truck crops in North Carolina was undertaken by the Experiment Station during the 1943 season. This survey was conducted in five counties specializing in the production of such crops as cabbage, cantaloupes, fresh cucumbers, lima beans, May peas, peppers, snap beans, squash, tomatoes, and watermelons.

Results of this study are now available for use by farmers and federal officials. The costs are expressed in terms of per unit of output and per acre. Cost rates used were those prevailing in 1943. Two calculations of cost were made, one showing the cost for the actual production on the farms surveyed in 1943 and the other showing the estimated cost with a normal yield. In calculating the cost, no change was made to cover risk or return to management.

It is obvious from the information gathered that the cost per unit is greatly affected by the yields per acre. For example, with normal yields, it will cost $1.39 per bushel to produce lima beans. However, the yields in 1943 were unusually low and as a result, the cost to produce a bushel of lima beans was $9.41. The effect of low yields in 1943 was also evident in the data for such crops as May peas, peppers, tomatoes, and snap beans.

Because of this variation in the yields of truck crops, it is hard to set a fair floor or ceiling price. For instance, during the past season farmers growing cabbage made excellent profits; whereas those producing lima beans and May peas lost heavily. On the whole, however, the prices received by truck crop growers were satisfactory.

EXPERIMENTAL--STATISTICS RESEARCH

New Experimental Designs Save Time and Money

Decreased personnel on the Station staff and the urgent need for accurate information in the shortest possible time have given great impetus to the activities of the Department of Experimental-Statistics. The functions of this department are (1) to devise more efficient ways of obtaining information, whether by surveys or by experimentation, and (2) to provide computational service to other departments of the Station.

The department is helping to increase the efficiency of the Station by assisting with the planning and analysis of experiments. The use of new incomplete block designs increased the precision of over 125 experiments by an average of 55 per cent. Approximately 20,000 plots were involved in these experiments and to get the same degree of accuracy with older methods, 31,000 plots would have been required. Since the operational cost of variety test plots such as these is around 25 cents apiece, this one service represented a saving of about $2,700, exclusive of the saving in the time of the investigators.

Although these services are not useful to farmers directly, they enable the subject matter workers to obtain their information cheaper and quicker.

New Sampling Methods Prove Useful

The Statistical Laboratory joined forces with the Federal-State Crop Reporting Service in several studies to provide North Carolina farmers with more detailed and more accurate figures about the agricultural situation in the state. Figures for about 200,000 farms from the 1943 North Carolina State Farm Census were retabulated to give detailed figures on the geographic distribution of crops and livestock and the distribution of crops and livestock among individual farms. Methods were developed for improving estimates of grain stocks, grain disposition, livestock numbers, crop acreages, crop yields, and farm employment. Some of these improved methods are now in operation in North Carolina and other states.

COOPERATION WITH THE UNITED STATES DEPARTMENT OF AGRICULTURE AND OTHER FEDERAL AGENCIES

BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY
- Food Research Division
- Regional Research Laboratories

BUREAU OF AGRICULTURAL ECONOMICS
- Division of Agricultural Statistics
- Division of Farm Management and Costs

BUREAU OF ANIMAL INDUSTRY
- Animal Husbandry Division

BUREAU OF DAIRY INDUSTRY
- Division of Dairy Cattle Breeding, Feeding, and Management

BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING
- Division of Cereal Crops and Diseases
- Division of Cotton and Other Fiber Crops and Diseases
- Division of Forage Crops and Diseases
- Division of Fruit and Vegetable Crops and Diseases
- Division of Soils and Fertilizer Investigations
- Division of Soil Survey
- Division of Tobacco and Plant Nutrition

FOREST SERVICE
- Division of Range Research
- Appalachian Forest Experiment Station

SOIL CONSERVATION SERVICE
- Conservation Experiment Stations Division
- Nursery Division

TENNESSEE VALLEY AUTHORITY
- Agricultural Relations Department

COOPERATION WITH INDUSTRIES

AMERICAN POTASH INSTITUTE
- "Placement of Potash for Peanuts and Rate of Potash Studies on Three Soybean Varieties."
- "Investigations on the Boron Content of the Major Soil Types and Its Availability to Plants, and the Response of Plants to Added Boron in the State of North Carolina."

THE BARRETT DIVISION, ALLIED CHEMICAL AND DYE CORPORATION
- "Use of Liquid Forms of Nitrogen for Topdressing Purposes."

CROP PROTECTION INSTITUTE
- "Peanut Disease Control and Cotton Seed Treatment Studies."

DOW CHEMICAL COMPANY
- "Cotton and Soybean Seed Treatment Studies."

INTERNATIONAL MINERALS AND CHEMICAL CORPORATION
- "Factors Affecting Maximum Response of Crops to Nitrogen."

ROHM AND HAAS COMPANY
- "Peanut Disease Control Studies."

SWIFT AND COMPANY
- "Meat Packing By-Products as Sources of Cystine in Swine Rations."

TENNESSEE CORPORATION
- "Peanut and Apple Disease Control Studies."

UNITED STATES RUBBER COMPANY
- "Cotton and Soybean Seed Treatment Studies."

PUBLICATIONS

EXPERIMENT STATION BULLETINS

1. Collins, E. R., and Colwell, W. E. *Maintain Soil Fertility by a Planned Fertilization Program.* Research and Farming 1:10. March, 1943.
2. Dearstyne, R. S. *Some Recent Developments in Poultry and Turkey Research.* Research and Farming 1:11. March, 1943.
3. Foster, J. E. *Control Sheep Parasites and Increase Meat, Wool and Medical Supplies for the War.* Research and Farming 1:9. March, 1943.
4. Forster, G. W., Hamilton, C. H., Greene, R. E. L., and Mayo, S. C. *Farm Manpower Situation, North Carolina, 1943.* N. C. Agr. Exp. Sta. Bul. 340. 1943.
5. Gardner, M. E. *Preservation and Utilization of Food and Feed Crops as Related to the War Effort.* Research and Farming 1:2. March, 1943.
6. Greene, R. E. L. *Survey Shows Cost of Producing Milk.* Research and Farming 1:3. March, 1943.
7. Hendricks, W. A. *Methods of Estimating Farm Employment from Sample Data in North Carolina.* N. C. Agr. Exp. Sta. Tech. Bul. 75. 1943.
8. Hendricks, W. A. *Techniques in Measuring Joint Relationships.* N. C. Agr. Exp. Sta. Tech. Bul. 74. 1943.
9. Hendrix, A. T. *Sweet Potato Vines Harvested for Livestock Feed.* Research and Farming 1:8. March, 1943.
10. Hostetler, E. H., Peterson, W. J., and Shaw, A. O. *Feeding Soybeans to Pigs.* Research and Farming 1:6. March, 1943.
11. Lee, W. D. *Land Cover in Relation to Water Control in the Upper French Broad River Watershed.* N. C. Agr. Exp. Sta. Bul. 339. 1943.
12. Lehman, S. G. *Reginning and Dusting Cotton Seed Help Win the War.* Research and Farming 1:5. March, 1943.
13. Lovvorn, R. L. *Realizing Greater Returns from North Carolina Permanent Pastures.* Research and Farming 1:1. March, 1943.
14. Shaw, A. O., Biswell, H. H., Foster, J. E., and Collins, R. W. *Some Stock-Poisoning Plants of North Carolina.* N. C. Agr. Exp. Sta. Bul. 342. 1943.
15. Smith, C. F. *Scale Insects Harm Peach Trees in North Carolina.* Research and Farming 1:12. March, 1943.
16. Willis, L. G. *Borax Remedies Cracking of Sweet Potatoes.* Research and Farming 1:4. March, 1943.
17. Winston, Sanford. *Education of Farm Leaders in Selected Rural Counties of North Carolina.* Research and Farming 1:7. March, 1943.

EXTENSION CIRCULARS

1. Ellis, D. E. *Treat Lettuce Seed for Better Stands.* N. C. Ext. Circ. 269. 1943.
2. Etchells, J. L., and Jones, I. D. *Preservation of Vegetables by Salting and Brining.* AIC-r, N. C. Agr. Ext. Service. (Mimeographed). 1943.
3. Shaw, Luther. *Why and How to Treat Peanut Seed.* N. C. Ext. Bul. 18. (War Series). 1943.

MISCELLANEOUS PUBLICATIONS

1. Atkins, S. W., Greene, R. E. L., and Larkin, R. C. *Farm Labor and Power Used on Cotton-Tobacco Farms, Franklin County, North Carolina.* AE Information Series No. 10. (Mimeographed). 1943.
2. Bullock, J. F., and Moss, E. G. *Strains of Flue-Cured Tobacco Resistant to Blackshank.* USDA Circ. 682. 1943.
3. Cummings, R. W. *Principles Determining Where Fertilizer Should Be Placed for Greatest Efficiency.* Proc. Nat'l Joint Comm. on Fert. Placement. 1943.
4. Etchells, J. L., and Jones, I. D. *Preservation of Vegetables by Salting or Brining.* USDA Farmers Bul. 1932. 1943.
5. Forster, G. W., et al. *North Carolina State Report on Agricultural Wartime Production Capacity.* (Mimeographed). 1943.
6. Forster, G. W., and James, H. B. *The Size of Farms as a Factor Affecting Maximum Wartime Production Capacity in North Carolina.* A supplement to the report on Agricultural Wartime Production Capacity. (Mimeographed). 1943.
7. Giles, G. W., and Collins, E. R. *A Once-Over, One Mule Fertilizer Distributor and Seed Planter.* Proc. 18th Ann. Meeting Nat'l Joint Comm. on Fert. Application. 1942.
8. Giles, G. W., Nelson, W. L., et al. *Studies on One-Row, Side-Placement Distributors and Planters for Cotton.* Proc. 18th Ann. Meeting Nat'l Joint Comm. on Fert. Application. 1942.
9. Greene, R. E. L. *Asheville Milk Shed Cost of Milk Production, April 1, 1942-March 31, 1943.* AE Information Series No. 11. (Mimeographed). 1943.
10. Greene, R. E. L., and Derr, D. E. *Manpower Utilization in Relation to Agricultural Resources, Davidson County, North Carolina.* (Mimeographed). 1943.
11. Greene, R. E. L., James, H. B., and Downing, J. C. *A Study of Cost and Income from Peanuts.* (Lithographed). 1943.
12. Hamilton, C. H., and Henderson, F. M. *Migration from North Carolina Farms.* University of North Carolina News Letter. V. 29, No. 4. 1943.
13. Larkin, R. C., and Atkins, S. W. *An Appraisal of the Permanent Pasture Program of the Soil Conservation Service, Franklin County, North Carolina.* (Lithographed). 1943.
14. Mayo, S. C., and Hamilton, C. H. *Farm Labor Available in an Urban Center: Washington, N. C.* Progress Report RS-1. (Mimeographed). 1943.
15. Moore, R. P., and Bennett, L. S. *Official Variety Tests in North Carolina —Small Grains.* Agron. Information Circ. 132. (Lithographed). 1943.
16. *Official Variety Tests in North Carolina, 1942.* Agron. Information Circ. 131. (Lithographed). 1942.
17. Peterson, W. J. *What the Feed Manufacturer Should Know About Nutrition in War Time.* Bulletin, N. C. Dept. of Agr. 1942.
18. Peterson, W. J., Sherwood, F. W., Weaver, J. G., Speirs, Mary, and Cochran, H. L. *The Carotene and Ascorbic Acid Content of Sweet Potatoes. I. The Effect of Curing and Storage. II. The Effects of Boiling and Baking.* Nat'l Cooperative Project on the Conservation of Nutritive Value of Foods. Progress Notes. (Mimeographed). 1943.

19. Shaw, A. O. *Profitable Feeding of Cattle.* Bulletin, N. C. Dept. of Agr. 1942.
20. Smith, C. F. *Peach Tree Borer Control Recommendations, 1943.* (Mimeographed). 1943.

SCIENTIFIC JOURNAL ARTICLES

1. Anderson, D. B., and Kerr, Thomas. *A Note on the Growth of Cotton Bolls.* Plant Physiology 18:261-269. 1943.
2. Burkhart, Leland. *Firmness of Strawberries as Determined by Penetrometer.* Plant Physiology 18:693-698. 1943.
3. Clayton, E. E., Smith, T. E., Shaw, K. J., Gaines, J. G., Graham, T. W., and Yeager, C. C., Jr. *Fungicidal Tests on Blue Mold (Peronospora tabicina) of Tobacco.* Jour. Agr. Research 66:261-276. 1943.
4. Cox, Gertrude M., McKay, H., et al. *Calcium, Phosphorus and Nitrogen Metabolism of Young College Women.* Jour. Nutrition 24:367-384. 1942.
5. Ellis, D. E. *Rootknot Resistance in Lycopersicon peruvianum.* Plant Disease Reporter 27:402-404. 1943.
6. Ellis, D. E. *Soil Treatments with Sodium Nitrite for Controlling Damping-Off and Rootknot.* Phytopathology 33:1110-1111. (Abst.). 1943.
7. Etchells, J. L., and Jones, I. D. *Bacteriological Changes in Cucumber Fermentation.* Food Industries 15:54-56. 1943.
8. Etchells, J. L., and Jones, I. D. *Commercial Brine Preservation of Vegetables.* Fruit Products Jour. 22:242-246, 251-253. 1943.
9. Etchells, J. L., and Jones, I. D. *Mortality of Microorganisms During Pasteurization of Cucumber Pickle.* Food Research 8:33-44. 1943.
10. Etchells, J. L., Jones, I. D., and Hoffman, M. A. *Brine Preservation of Vegetables.* Proceedings of Institute of Food Technologists. 176-182. 1943.
11. Feldman, A. W., and Shaw, Luther. *Sodium Nitrite for Rootknot Control.* Phytopathology 33:1111. (Abst.). 1943.
12. Forster, G. W. *Contribution of Farm Management Research to Attainment of Production Goals.* Jour. of Farm Economics 25:110-119. 1943.
13. Gibson, R. M., Lovvorn, R. L., and Smith, B. W. *Response of Soybeans to Experimental Defoliation.* Jour. Amer. Soc. Agron. 35:768-778. 1943.
14. Harvey, P. H., and Schultz, E. F., Jr. *Multiplying Peanut Hybrids by Vegetative Propagation.* Jour. Amer. Soc. Agron. 35:637-639. 1943.
15. Jones, I. D., and Etchells, J. L. *Physical and Chemical Changes in Cucumber Fermentation.* Food Industries 15:62-64. 1943.
16. Lehman, S. G. *Vapor Action of Certain Fungicidal Materials Prepared for Dusting Cotton Seed.* Phytopathology 33:431-448. 1943.
17. Lineberry, R. A., and Burkhart, Leland. *Nutrient Deficiencies in the Strawberry Leaf and Fruit.* Plant Physiology 18:324-333. 1943.
18. Lineberry, R. A., and Burkhart, Leland. *The Stability of Vitamin C in Small Fruits.* Fruit Products Jour. 22:164-165, 177. 1943.
19. Lyle, J. A., and Shaw, Luther. *Fermate Offers Promise in the Control of Frog-Eye Leaf Spot (Sphaeropsis malorum) of Apple.* Phytopathology 33:1116-1117. (Abst.). 1943.
20. Mayo, S. C. *Two Factors in Urban Population Growth.* Social Forces 22:80-81. 1943.
21. Mehlich, Adolf. *Base Saturation and pH in Relation to Liming and Nutrient Conservation of Soil.* Soil Sci. Soc. Amer. Proc. 7:353-361. 1942.

22. Mehlich, Adolf. *The Significance of Percentage Base Saturation and pH in Relation to Soil Differences.* Soil Sci. Soc. Amer. Proc. 7:167-174. 1942.
23. Moore, J. H. *Correlation of Combed Staple Length on the Cottonseed with Commercial Staple Length in American Upland Cotton.* Jour. Amer. Soc. Agron. 35:491-498. 1943.
24. Nielsen, L. W. *Sunscald as a Predisposing Factor to Soft Rot of Early Potatoes in Transit.* Phytopathology 33:1117. (Abst.). 1943.
25. Petersen, W. J., Brady, D. E., and Shaw, A. O. *Fluorometric Determination of Riboflavin in Pork Products.* Ind. and Eng. Chem. (Anal. Ed.). 15:634-636. 1943.
26. Peterson, W. J., Hostetler, E. H., and Shaw, A. O. *Studies in Feeding Soybeans to Pigs.* Jour. Anim. Sci. 1:360. 1942.
27. Smith, C. F. *Experiments with the Peach Tree Borer in North Carolina.* Jour. Econ. Entomology 36:215-218. 1943.
28. Smith, C. F., and Knowlton, G. F. *The Aphis Genus Drepanaphis Del Guestcio.* Jour. Elisha Mitchell Soc. 59:171-176. 1943.
29. Smith, T. E. *Distribution of Bacterial Wilt (Bacterium solanacearum) in Successive Crops of Tobacco Grown on the Same Fields.* Phytopathology 33:1076-1080. 1943.
30. Smith, T. E., and Clayton, E. E. *Control of Granville Wilt (Bacterium solanacearum) of Tobacco and Other Plants by Applications of Urea to the Soil.* Phytopathology 33:11-12. 1943.
31. Smith, T. E., and Shaw, K. J. *Pathogenicity Studies with Fusaria Isolated from Tobacco, Sweet Potato and Cotton.* Phytopathology 33:469-483. 1943.
32. Sullam, V. B. *Some Limitations of the "Live-at-Home" Programs.* Rural Sociology 8:24-35. 1943.
33. Winston, Sanford, and Butler, Mosette. *Negro Bootleggers in Eastern North Carolina.* Amer. Sociological Review 8:692-697. 1943.
34. Woodhouse, W. W., Jr., and Morris, H. D. *Effect of Vitamin B_1 on Field Crops Grown on Several North Carolina Soils.* Jour. Amer. Soc. Agron. 34:322-326. 1942.

OFFICERS AND STAFF

of the

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

December 1, 1943

ADMINISTRATION

L. D. Baver, Ph.D. — *Director*
Nettie D. Haywood, A.B. — *Secretary*
F. H. Jeter, B.S. — *Editor*
Mrs. L. B. Judd — *Clerk*
F. E. Miller, B.S. — *Director of Branch Stations*
J. G. Vann, B.S. — *Assistant Controller*
Phyllis Yates, A.B. — *Assistant Editor*

AGRICULTURAL ECONOMICS

G. W. Forster, Ph.D. — *Head of Department*
R. L. Anderson, Ph.D. — *Assistant*
F. D. Barlow, M.S. — *Associate*
R. E. L. Greene, Ph.D. — *Associate, Farm Management*
[6]H. Brooks James, M.S. — *Associate*
H. A. White, B.S. — *Associate*

AGRICULTURAL ENGINEERING

D. S. Weaver, M.S. — *Head of Department*
G. W. Giles, M.S. — *Associate, Farm Machinery*
N. C. Teter, M.S. — *Assistant*

AGRONOMY

R. W. Cummings, Ph.D. — *Head of Department*
L. S. Bennett, Ph.D. — *Assistant, Seed Improvement*
N. C. Brady, B.S. — *Assistant, Soil Fertility*
L. F. Burkhart, Ph.D. — *Assistant, Soil Fertility*
D. S. Chamblee, B.S. — *Assistant, Forage Crops*
E. R. Collins, Ph.D. — *Associate, Soil Fertility*
W. E. Colwell, Ph.D. — *Associate, Soil Fertility*
[5]T. L. Copley, M.S. — *Associate, In Charge, Soil Conservation*
[5]L. A. Forrest, M.S. — *Assistant, Soil Conservation*
Leah Fleming, A.B. — *Laboratory Technician*
[7]Wm. Gettys, B.S. — *Assistant, Soil Survey*
[7]E. F. Goldston, B.S. — *Assistant, Soil Survey*
Lillian Ruth Greene, A.B. — *Laboratory Technician*
[1]W. C. Gregory, Ph.D. — *Assistant, Corn Breeding*
[1]E. E. Hartwig, Ph.D. — *Associate, Forage Crops*
[1]P. H. Harvey, Ph.D. — *Associate, In Charge, Corn Breeding*
[1]Thos. Kerr, Ph.D. — *Associate, Cotton Technology*
[1]P. H. Kime, M.S. — *Associate, Cotton Breeding*

[1]B. A. Krantz, Ph.D. — *Assistant, Soil Fertility*
[1]W. D. Lee, B.S. — *Associate, In Charge, Soil Survey*
[1]W. S. Leighty, B.S. — *Assistant, Soil Survey*
[1]R. A. Lineberry, Ph.D. — *Assistant, Soil Fertility*
[1]R. L. Lovvorn, Ph.D. — *Associate, In Charge, Forage Crops*
J. F. Lutz, Ph.D. — *Associate, Soils*
R. W. McMillen, M.S. — *Assistant, Small Grain Breeding*
Adolf Mehlich, Ph.D. — *Associate, Soil Chemistry*
G. K. Middleton, Ph.D. — *Associate, Head, Field Crops Section*
J. H. Moore, Ph.D. — *Associate, Cotton Technology*
R. P. Moore, Ph.D. — *Associate, Seed Improvement*
[1]E. G. Moss, B.S. — *Associate, In Charge, Tobacco Investigations, Oxford, N. C.*
W. L. Nelson, Ph.D. — *Assistant, Soil Fertility*
Elizabeth B. Phelps, B.S. — *Laboratory Technician*
J. R. Piland, M.S. — *Assistant, Soil Chemistry*
W. H. Rankin, M.S. — *Associate, Soil Fertility*
J. F. Reed, Ph.D. — *Associate, Soil Chemistry*
J. A. Rigney, M.S. — *Associate, Forage Crops*
E. F. Schultz, Jr., B.S. — *Assistant, Plant Breeding*
B. W. Smith, Ph.D. — *Assistant, Forage Crop Breeding*
Lois Stevenson — *Laboratory Assistant*
[1]R. E. Stitt, Ph.D. — *Assistant, Forage Crops, Statesville, N. C.*
A. D. Stuart, M.S. — *Associate, Seed Improvement*
[1]R. H. Tilley, B.S. — *Assistant, Cotton Breeding, Statesville, N. C.*
C. B. Williams, M.S. — *Agronomist*
[7]W. W. Woodhouse, Jr., M.S. — *Associate, Soil Fertility*

ANIMAL INDUSTRY

A. O. Shaw, Ph.D. — *Head of Department*
J. A. Ammerman, B.S. — *Assistant, Animal Husbandry*
Hartlee M. Baxley, B.S. — *Laboratory Technician*
D. E. Brady, Ph.D. — *Associate, In Charge, Meats Research*
R. E. Comstock, Ph.D. — *Associate, In Charge, Genetics Research*
[3]E. W. Faires, B.S. — *Assistant, Dairy Section, Willard, N. C.*
[2]J. E. Foster, Ph.D. — *Associate, In Charge, Beef Cattle and Sheep Research*
C. D. Grinnells, D.V.M., M.S. — *Associate, Head, Dairy Section*
Frances Gyles, A.B. — *Laboratory Technician*
J. O. Halverson, Ph.D. — *Associate, Animal Nutrition*
[2]E. H. Hostetler, M.S. — *Associate, Head, Animal Husbandry Section*
Mrs. Mary A. Monteith, A.B. — *Laboratory Technician*
J. L. Moore, M.S. — *Assistant, Dairy Section*
W. J. Peterson, Ph.D. — *Associate, Head, Nutrition Section*
W. M. Roberts, M.S. — *Associate, Dairy Manufacture*
F. W. Sherwood, Ph.D. — *Associate, Nutrition*
F. H. Smith, M.S. — *Assistant, Nutrition*
Virginia Weldon, A.B. — *Laboratory Technician*

BOTANY

B. W. Wells, Ph.D. — *Head of Department*
D. E. Ellis, M.S. — *Assistant, Vegetable Diseases*
S. G. Lehman, Ph.D. — *Associate, Cotton Diseases*

J. A. Lyle, B.S. ..... *Assistant*
L. W. Nielsen, Ph.D. ..... *Assistant, Potato Diseases*
Luther Shaw, Ph.D. ..... *Associate, In Charge, Plant Pathology*
[1]T. E. Smith, Ph.D. ..... *Associate, Tobacco Diseases, Oxford, N. C.*

EXPERIMENTAL-STATISTICS

Gertrude M. Cox, M.S. ..... *Head of Department*
R. L. Anderson, Ph.D. ..... *Assistant, Economic Statistics*
R. E. Comstock, Ph.D. ..... *Associate, Animal Science Statistics*
[6]W. A. Hendricks, M.A. ..... *Agricultural Statistician*
Virginia Montague, A.B. ..... *Assistant*
J. A. Rigney, M.S. ..... *Associate, Plant Science Statistics*
[6]Glen F. Vogel, B.A. ..... *Agricultural Statistician*

FORESTRY

J. V. Hoffman, Ph.D. ..... *Head of Department*
[2]G. E. Jackson, B.S. ..... *Assistant*
Clemens Kaufman, Ph.D. ..... *Assistant*

HORTICULTURE

M. E. Gardner, B.S. ..... *Head of Department*
[1]Chas. T. Dearing, B.S. ..... *Associate, Grape Investigations, Willard, N. C.*
[4]J. L. Etchells, M.S. ..... *Assistant, Bacteriology*
Eleanor Gibbs, A.B. ..... *Laboratory Technician*
Ivan D. Jones, Ph.D. ..... *Associate, Biochemistry*
L. G. McLean, M.S. ..... *Associate, Flowers and Nursery*
E. B. Morrow, M.S. ..... *Associate, Small Fruits*
G. O. Randall, M.S. ..... *Associate*
C. E. VanDeman, B.S. ..... *Assistant, Pomology*
Otto Veerhoff, Ph.D. ..... *Associate, Physiology*
J. G. Weaver, M.S. ..... *Associate*
C. F. Williams, M.S. ..... *Associate, Small Fruits*

POULTRY

R. S. Dearstyne, M.S. ..... *Head of Department*
C. H. Bostian, Ph.D. ..... *Associate, Genetics*
H. C. Gauger, M.S. ..... *Associate, Bacteriology*
R. E. Greaves, M.S. ..... *Assistant, Serology*
Reinard Harkema, Ph.D. ..... *Assistant, Parasitology*
J. J. Hutchinson, B.S. ..... *Assistant, Poultry Breeding*
W. B. Nesbit, B.S. ..... *Assistant, Turkey Research*

RURAL SOCIOLOGY

C. Horace Hamilton, Ph.D. ..... *Head of Department*
S. C. Mayo, Ph.D. ..... *Assistant, Community Organization*
Sanford Winston, Ph.D. ..... *Associate, In Charge, Rural Leadership Research*

ZOOLOGY AND ENTOMOLOGY

Z. P. Metcalf, D.Sc. ..... *Head of Department*
B. B. Fulton, Ph.D. ..... *Associate, Entomology*
W. M. Kulash, Ph.D. ..... *Assistant, Entomology*

C. F. Smith, Ph.D. ..... *Associate, Entomology*

APPLE RESEARCH LABORATORY, NORTH WILKESBORO

C. E. Van Deman, B.S. ..... *Associate in Horticulture, In Charge*

PEACH RESEARCH LABORATORY, EAGLE SPRINGS

Edgar Graham ..... *Foreman*

SOIL RESEARCH LABORATORY, WILMINGTON

L. G. Willis, M.S. ..... *Director, In Charge*

CENTRAL STATION

R. J. Harris ..... *Assistant Director In Charge*
J. P. Ammerman, Jr. ..... *Foreman, Animal Husbandry*
N. L. Johnson ..... *Herdsman, Animal Husbandry*
L. Y. Parker ..... *Foreman*
J. S. Shears ..... *Herdsman, Dairy*

DAIRY RESEARCH FARM, STATESVILLE

B. F. Mills ..... *Foreman*

McCULLERS BRANCH STATION

J. L. Rand, A.B. ..... *Assistant Director In Charge*

[5]SOIL CONSERVATION EXPERIMENT STATION (Near Raleigh)

T. L. Copley, M.S. ..... *Project Supervisor*
Luke A. Forrest, M.S. ..... *Assistant Soil Conservationist*
M. T. Augustine, B.S. ..... *Project Engineer*
J. O. Knott ..... *Farm Foreman*

BRANCH STATIONS†

BLACKLAND BRANCH STATION, WENONA

[2]J. L. Rea, Jr., B.S., M.Agr. ..... *Assistant Director In Charge*
Herbert Allen ..... *Foreman*
[2]Dempsey Allen ..... *Herdsman*

LOWER COASTAL PLAIN BRANCH STATION, WILLARD

[1]Chas. T. Dearing, B.S. ..... *Assistant Director In Charge*
C. O. Bollinger ..... *Poultryman*
[3]E. W. Faires, B.S. ..... *Assistant, Dairying, Bureau of Dairy Industry, USDA*
D. P. Southerland ..... *Foreman*

MOUNTAIN BRANCH STATION, SWANNANOA

Dean W. Colvard, M.S. ..... *Assistant Director In Charge*
S. M. Correll, B.S. ..... *Dairy Herdsman*
J. E. Love ..... *Poultryman*
W. M. Whisenhunt ..... *Foreman*

PIEDMONT BRANCH STATION, STATESVILLE

[1]J. W. Hendricks, B.S. ..... *Assistant Director In Charge*

[1]R. E. STITT, Ph.D. ..... *Assistant Agronomist, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA*

[1]R. H. TILLEY, B.S. ..... *Assistant, Cotton Breeding, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA*

TOBACCO BRANCH STATION, OXFORD

[1]E. G. MOSS, B.S. ..... *Assistant Director In Charge*

[1]T. E. SMITH, Ph.D. ..... *Associate, Tobacco Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA*

UPPER COASTAL PLAIN BRANCH STATION, ROCKY MOUNT

R. E. CURRIN, JR. ..... *Assistant Director In Charge*

WM. ALLSBROOK ..... *Foreman*

---

† The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

[1] In cooperation with Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.

[2] In cooperation with Bureau of Animal Industry, U.S.D.A.

[3] In cooperation with Bureau of Dairy Industry, U.S.D.A.

[4] In cooperation with Bureau of Agricultural and Industrial Chemistry, U.S.D.A.

[5] In cooperation with Soil Conservation Service, U.S.D.A.

[6] In cooperation with Bureau of Agricultural Economics, U.S.D.A.

[7] In cooperation with Tennessee Valley Authority.

AUDITOR'S CERTIFICATE

We, the undersigned, certify that the receipts and expenditures shown in this report from Federal funds and as offset to Bankhead-Jones funds are correct; that the expenditures were solely for the purposes set forth in the acts of Congress approved March 2, 1887 (Hatch), March 16, 1906 (Adams), February 24, 1925 (Purnell), May 16, 1928 (Hawaii), February 23, 1929 (Alaska), March 4, 1931 (Puerto Rico), June 29, 1935 (Bankhead-Jones Title I), June 20, 1936 (Alaska), and March 4, 1940 (Employer Contributions to Retirement); that the expenditures are in accordance with the terms of said acts so far as applicable to this station; and that properly approved vouchers are on file for all expenditures.

	FEDERAL FUNDS					Bankhead-Jones Offset
	Hatch	Adams	Purnell	Bankhead-Jones	Total Federal Funds	
Balance from preceding year	None	None	None	None	None	
Receipts from the Treasurer of the United States	$15,000.00	$15,000.00	$60,000.00	$106,085.56	$196,085.56	
Receipts from sources within the state	.....	.....	.....	.....	.....	
Total	$15,000.00	$15,000.00	$60,000.00	$106,085.56	$196,085.56	$201,428.49
Disbursements	15,000.00	15,000.00	60,000.00	106,085.56	196,085.56	201,428.49
Balance June 30, 1942	None	None	None	None	None	

We further certify that the sum of $ None was the total amount earned as interest on the deposit of Hatch, Adams, Purnell, and Bankhead-Jones funds and that this amount has been remitted to the Treasury of the United States through the United States Department of Agriculture.

(Signed) L. D. BAVER,
Director of the Experiment Station
J. G. VANN,
Assistant Controller

ATTEST:
L. D. BAVER,
Custodian of the Seal.

FINANCIAL STATEMENT

The following is a certified statement of the receipts from the Treasurer of the United States and sales from the Station farms, with a record of their disbursements:

	FEDERAL FUNDS			
	Hatch Fund	Adams Fund	Purnell Fund	Bankhead Jones Fund
Dr.				
To receipts of the Treasury of the United States, as per appropriations for fiscal year ended June 30, 1942	$15,000.00	$15,000.00	$60,000.00	$106,085.56
Cr.				
Personal services	12,340.00	12,787.29	48,402.31	85,225.91
Travel	940.29	299.16	2,343.99	4,152.40
Transportation of things	14.92	22.61	8.13	331.14
Communication service	235.44	37.93	260.65	364.10
Heat, light, power, water, gas, electricity				223.26
Rent of space in buildings or equipment			720.00	140.65
Rent of land				806.75
Printing and Binding:				
Printing publications	1,109.00		232.70	17.35
Other printing and binding	254.79		83.97	13.72
Repairs and alterations to equipment, and other contractual services not otherwise classified	10.70	37.35	729.84	780.02
Supplies used in construction, repair, or alteration of buildings			83.71	149.13
Other supplies and materials	79.06	664.10	5,223.79	9,201.18
Equipment	15.80	1,151.56	1,910.91	4,679.95
TOTAL EXPENDITURES	$15,000.00	$15,000.00	$60,000.00	$106,085.56

Interest earned on Federal funds given above, during the period indicated, aggregating—NOTHING—, was covered by check No. —NONE—, drawn by —xxx—, to the order of the Department of Agriculture, to be deposited in the United States Treasury.

North Carolina Agricultural Experiment Station
In Account with Farm and Miscellaneous Receipts

Dr.

	For All Purposes	For Agricultural Investigations
State appropriations or allotments:		
Main station	$152,299.44	$143,590.15
Sales	33,484.20	33,484.20
Miscellaneous: Commercial Gifts	15,670.78	15,670.78
Balance brought forward from previous year	8,683.36	8,683.36
Total	210,137.78	201,428.49

Cr.

Personal services	102,760.42
Travel	9,460.71
Transportation of things	640.47
Communication service	2,112.43
Rents and utility services	2,689.07
Printing and binding	1,534.54
Other contractual services	3,395.97
Supplies and materials	30,626.01
Equipment	20,562.48
Lands and structures (Contractual)	1,042.53
War Bonus	11,021.91
Total Expenditures	185,846.54
Unexpended balance	15,581.95
Total Funds Available	201,428.49

THE AGRICULTURAL EXPERIMENT STATION
OF THE
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AND
NORTH CAROLINA DEPARTMENT OF AGRICULTURE, COOPERATING
L. D. BAVER, DIRECTOR
STATE COLLEGE STATION
RALEIGH